Railway Maintenance Engineer

olume 12 | CHICAGO: Transportation Building NEW YORK: Woolworth Building | AUGUST, 1916 | CLEVELAND: Citizens' Building LONDON: Queen Anne's Chambers | Number

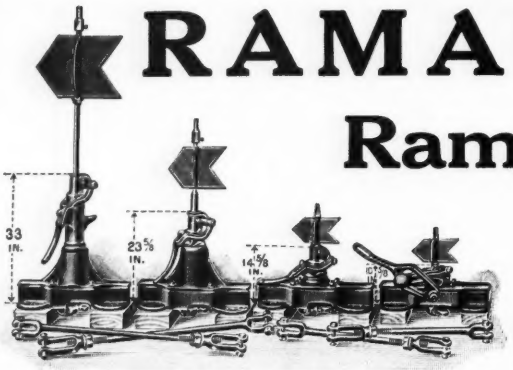
The Best Maintenance of Way Devices

the fact that they are standard on many of our large railway systems is the best argument that can be offered as to their safety and labor-saving qualities and general efficiency. Illustrated, descriptive catalog on request.

The Q & C Company

New York Chicago

RAMAPO



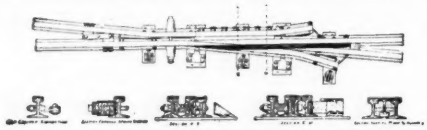
Automatic Safety Switch Stands are Manufactured only by the

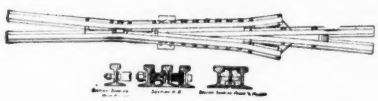
Ramapo Iron Works

Write for Descriptive Catalogues on
Switch Stands, Switches, Frogs, Guard Rail Clamps, Etc.

Manganese Track Work a Specialty.

Ramapo Iron Works Main Office: HILLBURN, N. Y.
WORKS: Hillburn, N. Y., and Niagara Falls, N. Y.





The CINCINNATI FROG & SWITCH COMPANY
MANUFACTURERS OF
TRACK EQUIPMENT
FOR STEAM AND ELECTRIC RAILROADS
MINES AND MILLS

Ask for Catalog 103

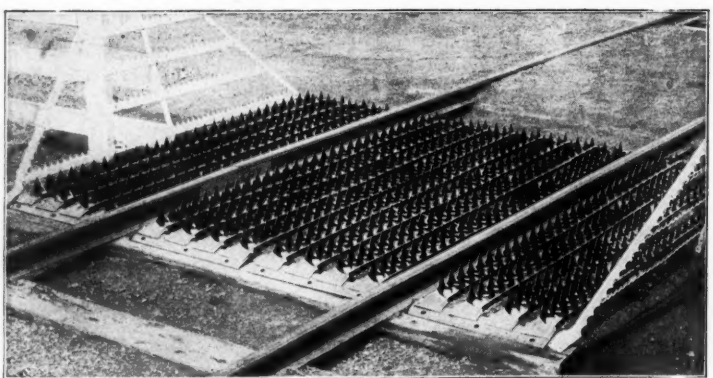
CINCINNATI, OHIO 2

ESTABLISHED 1882

THE WEIR FROG CO.

Track Work of Rail and Manganese Steel Construction

CINCINNATI --- --- --- --- --- OHIO



NATIONAL No. 10

National Surface Stock Guards

Are effective, durable, quickly installed, noiseless, easily removed for track repairs, and maintained at extremely low cost.

NATIONAL SURFACE GUARD CO.
The Rookery, Chicago, Ill.

A POSITIVE WATER SUPPLY AT ALL TIMES

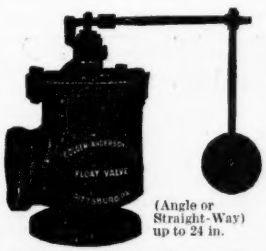
ABSOLUTELY ASSURED BY

G-A. Pat. Cushioned Controlling Altitude Valves

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyances of Freezing and Float Fixtures inside or outside of Tanks. "Three Ways of Closing These Valves:"

1st—Automatically by water.
2nd—By Electricity, if desired.
3rd—By Hand.

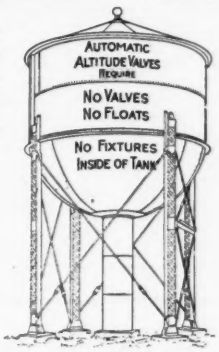
"No Metal-to-Metal Seats"

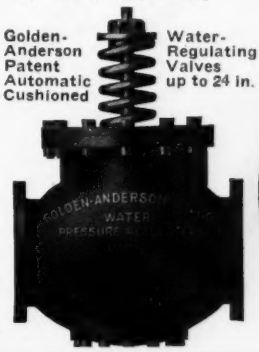


(Angle or Straight-Way) up to 24 in.

Golden-Anderson Automatic Cushioned Float Valves

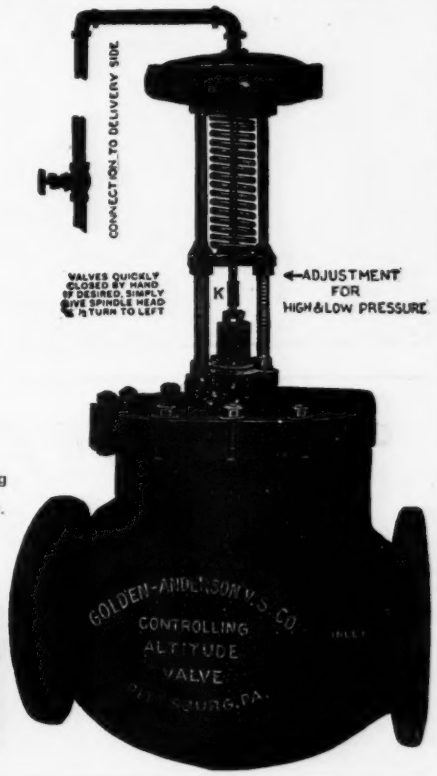
"Always Cushioned in Opening and Closing"





Golden-Anderson Patent Automatic Cushioned

Water-Regulating Valves up to 24 in.


CONNECTION TO DELIVERY SIDE
VALVES QUICKLY CLOSED BY HAND IF DESIRED, SIMPLY GIVE SPINDLE HEAD ¼ TURN TO LEFT
K
←ADJUSTMENT FOR HIGH & LOW PRESSURE
GOLDEN-ANDERSON V.S. CO.
CONTROLLING ALTITUDE VALVE

Golden-Anderson Valve Specialty Co.

Water and Steam Specialties

1200 Fulton Bldg. PITTSBURGH, PA.

KILBY FROG & SWITCH COMPANY

Birmingham, Alabama

Manufacturers of

Frogs, Switches, Crossings, Etc.

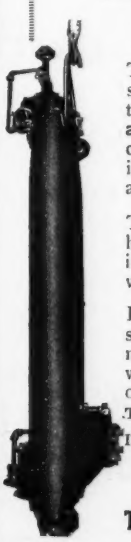
Manganese Track Work a Specialty

EMERSON STEAM PUMPS

Every railway engineering department ought to investigate Emerson Steam Pumps

For Railway Construction Work

Front View



Side View

The wonderful success of Emerson Standard Pumps is due to the **Emerson Patented Engine and Valve** with its positive mechanical motion admitting steam into the barrels of the pump at positively timed intervals.

The engine, valve, and gear are hermetically sealed, hence moving parts cannot come in contact with the material being pumped.

Finally, the "Emerson Standard" is a steam vacuum pump for pumping air, mud, sand, grit, etc., in percentages with the water, impossible by any other kind or make of pump.

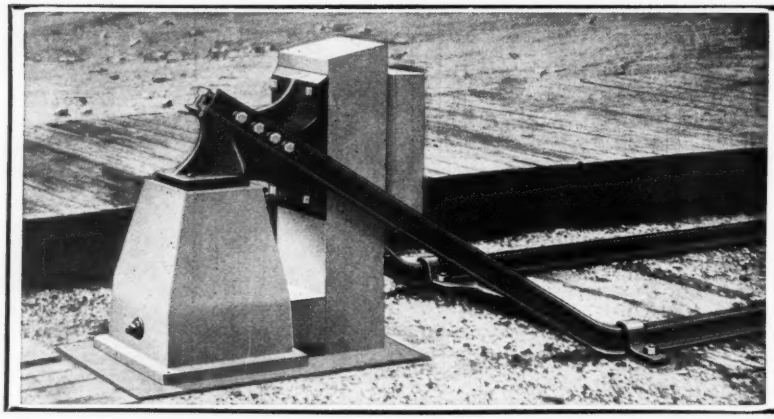
The New Emerson Has No Lubrication.

IMMEDIATE SHIPMENTS FROM STOCK

Catalog No. 12 contains full data, prices, interesting testimonials. May we forward a copy?

The Emerson Pump & Valve Company

Alexandria, Va., U. S. A.



ELLIS

PATENT

Bumping Post

Simple, Strong and Lasting
Adapted to All Positions

Mechanical Manufacturing Co.
Chicago, Ill.

"INDIANAPOLIS"

R. N. R. Solid Manganese Frogs

Are now so universally used by Leading Railways that we carry them in stock

FOR IMMEDIATE DELIVERY

THE INDIANAPOLIS SWITCH & FROG COMPANY

NEW YORK SPRINGFIELD CHICAGO

DOUBLE END TRACK WRENCH

HUBBARD

Shovels and Track Tools

For over a half century the quality of Hubbard tools has been clearly defined in the minds of the users as all that is excellent in material and workmanship.

All tools manufactured by us are guaranteed to be perfect in workmanship and material; if any prove defective in any way, prompt replacement will be made without charge.

Submit to us your blueprints or sketches of special tools and we will give you the benefit of our experience in designing them for your particular needs. Write for catalogues.

HUBBARD & COMPANY

Pittsburgh Pennsylvania

PLAIN BACK SPADE

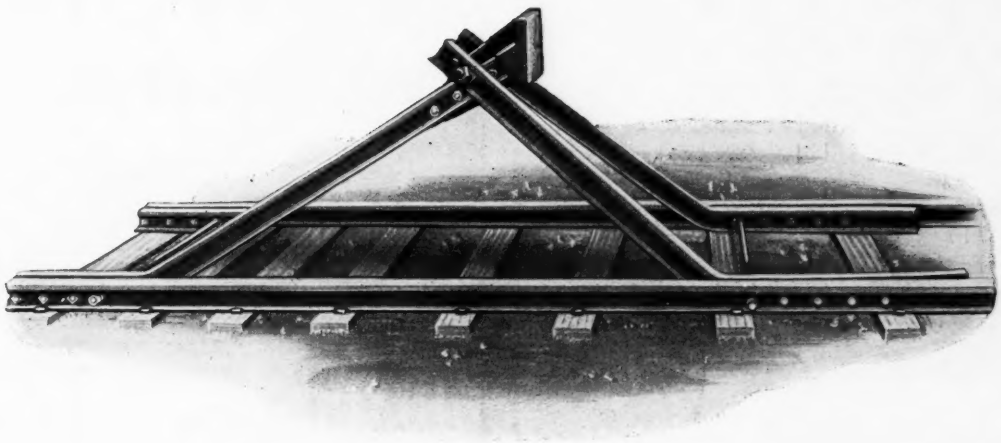
CLAW BAR

PLAIN BACK SHOVEL

BUDA ALL STEEL

PATENTED

BUMPING POST



Appearance of Buda All Steel Bumping Post **in a comparative test,** after being hit by a car of coal, total weight 68 tons, at a speed of six miles per hour on a down grade of 3½%, equaling 71,808,000 foot-pounds impact. **No damage done to car,** resiliency of the post acting as a spring buffer.

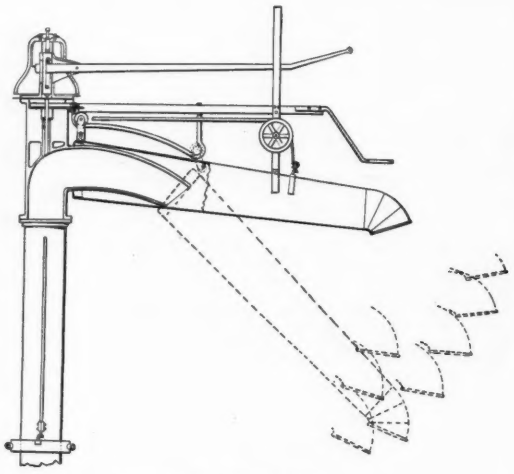
If you are interested, we should be glad to furnish you full particulars of this test. The only post that was not injured or totally demolished.

The Buda Company

30 Church St. New York

Railway Exchange Bldg. Chicago

113 No. 2nd St. St. Louis



DO YOU LOOK FOR THESE FEATURES IN A WATER COLUMN?

DROP SPOUT POSITIVELY NON-FREEZABLE

Non-freezable telescopic joint over the discharge nozzle of the tee—a joint that is entirely open, without packing or working apart, yet does not waste a bit of water.

WITH ABSOLUTE FLEXIBILITY

The greatest possible flexibility—a vertical adjustment range of five feet and a lateral adjustment range of three feet.

QUICK CLOSURE WITHOUT WATER HAMMER

A valve mechanism so constructed as to positively eliminate water hammer even when the column is connected to a high-pressure main. The University of Illinois comparative tests showed that the Poage Style H Valve offered the least frictional resistance to flow and that the valve closure is correct (University of Illinois Bulletin No. 48).

These features are found only in the

POAGE STYLE H WATER COLUMN EQUIPPED WITH THE FENNER DROP SPOUT

Actual everyday usage has proven that the Poage construction principles are correct. Give the Poage Style H Water Column a rigid tryout—see for yourself how maintenance costs are cut and time is saved. Write for illustrated booklet *now*.

The Poage Water Column and The Fenner Drop Spout are manufactured exclusively by

THE AMERICAN VALVE & METER CO.
CINCINNATI, U.S.A.

Long Time Protection

is given to steel cars, bridges, water and locomotive tanks, signal apparatus and all exposed metal and wood work by

DIXON'S SILICA GRAPHITE PAINT

The LONGEST SERVICE paint. Nature's combination of flake silica-graphite, mixed with pure boiled linseed oil, is the ideal combination which forms a firm, elastic coat that will not crack or peel off. This prevents access to agents which corrode and injure the metal. Dixon's Silica-Graphite Paint is used throughout the world by railroad engineers.

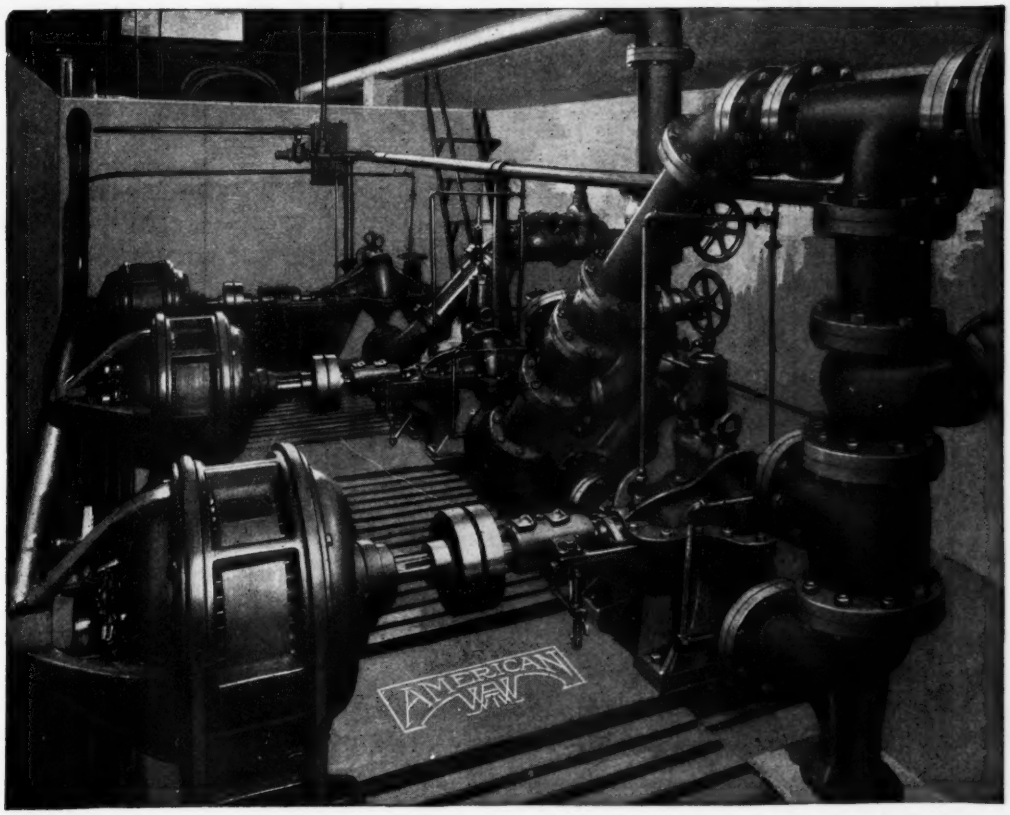
Why not write us for long service records and booklet No. 187B?

Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Company

Established 1827

AMERICAN



"American" Centrifugal Pump Economy in Railway Service

The economy of "American" centrifugal pumps in railroad service is illustrated by an installation of the Chicago & Eastern Illinois Railroad, at Villa Grove, Illinois, for supplying passenger and freight trains, locomotives, roundhouses and shops.

The plant consists of three 5-inch, Type DSMD 'American" double suction, split shell, enclosed impeller, motor driven centrifugal pumps installed in a pit six feet deep below the station floor level.

Water is taken from Embarrass River, 100 feet distant, by pump shown in far end of illustration, and delivered at the rate of 500 gallons per minute against a 21 foot total head into a surface reservoir and settling basin of several acres area. The discharge pipe from this pump passes through a side wall of the pit and is submerged in reservoir.

The other two units are duplicates, automatically controlled by pressure governor. These pumps operate separately, delivering water from reservoir to a 100,000 gallon elevated tank 1,200 feet distant near the shops. A pump starts when tank is half empty, delivering an average of 750 gallons per minute until tank is full. The pump then stops, remaining inactive until tank is again half empty.

Low head pump operates for several days, maintaining an efficiency of 66%. Each high head pump operates in turn at an average efficiency of 70%. Piping is so arranged that low head pump can deliver from river to reservoir while the others are either idle or delivering to tank, singly or in parallel, one automatically and one manually controlled. Middle unit can deliver from river to reservoir, from river to tank, or from river to auxiliary reservoir, through long pipe shown at top of illustration.

Motors are for 3-phase, 60 cycle, 440 volt current. Low head motor is 5 H. P. at 570 R.P.M. and each of the others is 25 H. P. at 1740 R.P.M.

The important features of this plant are: It is practically automatic; it is foolproof; it requires attention but once or twice a day; its installation was cheaper than the cost of revamping the steam plant and adding another tank, and it effects a saving in operating costs.

Saving in the total of pumping is the important feature in installations of "American" centrifugals. Catalog 132 describes them.

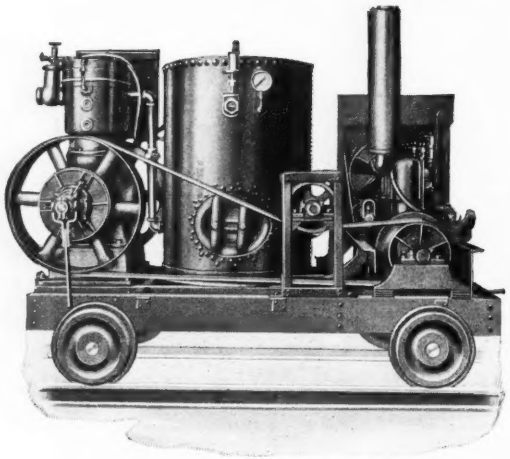
Write for it.

The American Well Works

General Office and Works: Aurora, Ill.

Chicago Office, First National Bank Building

For All Kinds of Railroad Repair Work



Capacity 140 cu. ft. free air per min.

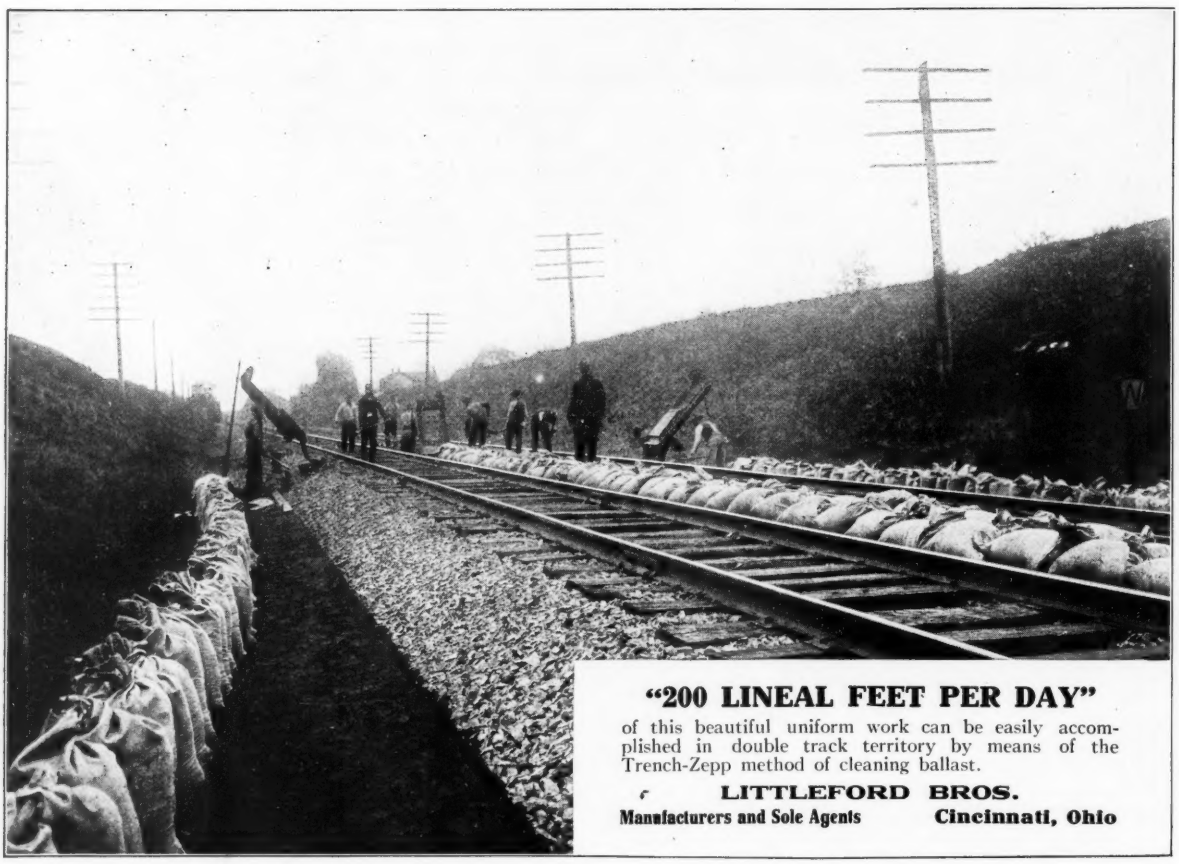
No heavy steam boilers—no coal—no bother, just a portable Zin-Ho Air Compressor for any railroad job that comes along.

ZIN-HO Portable Air Compressor

Built in several sizes for bridge work, sand blasting and repairing cars.

Continuous operation 24 hours a day if necessary. Write for details.

ZIN-HO MANUFACTURING CO., 1326 Michigan Avenue, CHICAGO



"200 LINEAL FEET PER DAY"

of this beautiful uniform work can be easily accomplished in double track territory by means of the Trench-Zepp method of cleaning ballast.

LITTLEFORD BROS.

Manufacturers and Sole Agents **Cincinnati, Ohio**

"Better Than Is Necessary"

is the sharpest criticism passed by the keenest critic on the merits of REILLY IMPROVED CREOSOTE OIL, the Premier Wood Preservative. In other words, REILLY IMPROVED CREOSOTE OIL is better than the best Creosote Oil previously known. "Just a little bit better than the specifications" has been our slogan for twenty years, but our zenith was reached in REILLY IMPROVED CREOSOTE OIL. We cannot improve it. It is the wood preservative that outlasts the wood. It stays put. There is no loss by evaporation. Wood preserved with it is preserved through and through and will last until it is mechanically worn out.

With REILLY IMPROVED CREOSOTE OIL at a cost no greater than that of many of the inferior oils, there is no logical reason why its use in Cross-Ties, Bridge Timbers and Piling should not be universal.

We are manufacturers of all grades of Creosote Oil. We can furnish promptly in any quantities REILLY IMPROVED CREOSOTE OIL, Maintenance of Way Oils No. 1, 2 and 3; Commercial Creosote Oils or Creosote Oils to meet any particular specification.

Let us figure with you on your next lot of Creosoted Cross-Ties, Bridge Timbers, Piling, Wooden Blocks for heavy duty floors, Telegraph and Telephone Poles and Cross-Arms. Delivery anywhere. Prices the lowest consistent with quality. Correspondence cordially invited.

Republic Creosoting Company

Principal Offices: Indianapolis, Ind.

Plants: Indianapolis Mobile Minneapolis Seattle

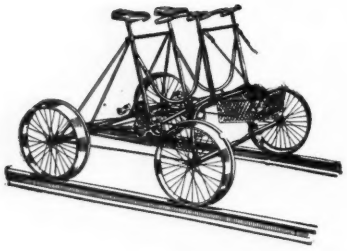
Making derails is only a small part of the railway supply field. But for thirteen years we have cultivated this part intensively. We began business in 1903 with little except an invention and a determination to succeed.

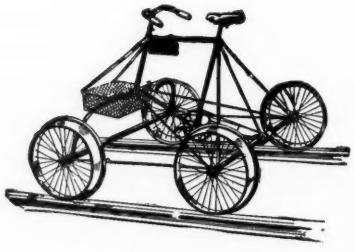
Since the first move from rented quarters our office and factory have been kept together. The close personal supervision of every detail of manufacture which this has made possible has had its effect on the finished product. Equipped with a training in mechanical engineering and long experience in railway maintenance, an experimental department has been kept going from the first. Derails and attachments alone have been studied. The original invention has been developed, expanded and perfected. Office and factory have had one slogan: "Nothing but derails but the best derails that exhaustive study and thorough methods can produce."

Success has been achieved by doing one thing well and keeping everlastingly at it. Nearly 100,000 Hayes Derails in track today in all parts of the world bear witness.

Hayes Track Appliance Co., Richmond, Indiana

HARTLEY & TEETER

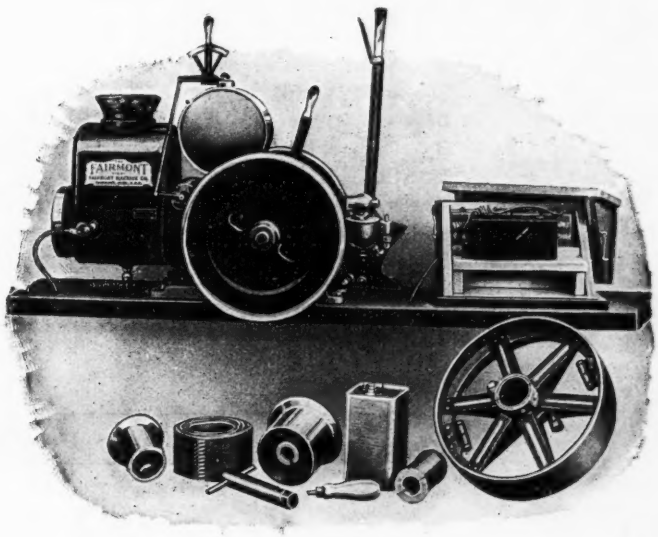




Light Inspection Cars are the Strongest and Lightest running known. The fact that we constantly receive repeat orders is proof absolutely that our cars are giving entire satisfaction. We shall be pleased to supply you with our new catalog that tells all about them.

TEETER-HARTLEY MOTOR CO.

HAGERSTOWN, INDIANA



Fairmont Engine for converting Hand Car Truck into Motor Car
4 H.P. 220 lbs. 6 H.P. 350 lbs. 8 H.P. 540 lbs.

WHY SO GOOD

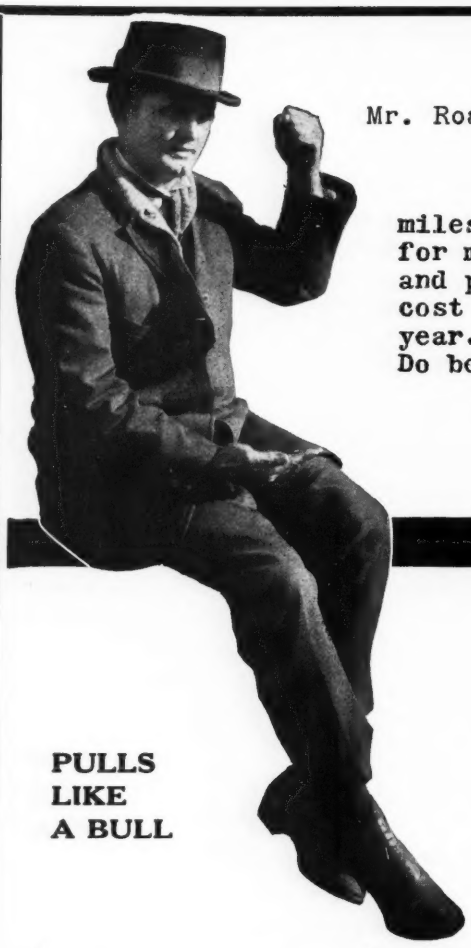
Why do FAIRMONT Hand Car Engines give such unequalled service? You know they have no successful rivals.

1. Water Cooled, they can't overheat and therefore they haul amazing loads for their small size and light weight.
2. Patented FAIRMONT Type of Design combines lightness and smooth power with half the usual gasoline consumption and marvelous range of throttle control.
3. Simple, without 4-cycle poppet cylinder valves, repairs are almost nothing.
4. Ask the Purchasing Agent or Roadmasters of almost any big system. Most of them are constantly buying FAIRMONTS.
5. Write for catalog now—it shows a great line of cars as well as engines.
6. Quantity prices to companies, easy terms to railroad men.

FAIRMONT GAS ENGINE & RAILWAY MOTOR CAR CO.

Formerly Fairmont Machine Company

423 N. Main Street, Fairmont, Minnesota

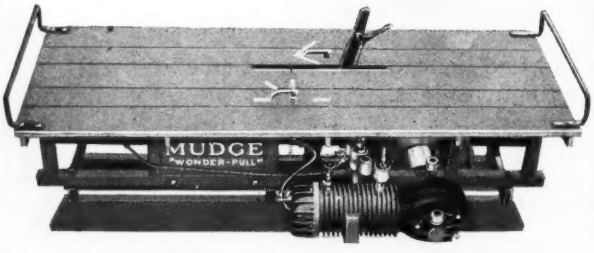


Mr. Roadmaster:

Lengthen my section from 6 to 10 miles --- give me a Mudge "Wonder-Pull" for my old hand car --- I'll then guarantee and prove to you how I can save its total cost --- by time saved --- in less than a year. I can then pay you handsome dividends. Do better work. Keep better men.

Section Foreman

PULLS LIKE A BULL



J. A. Rose speaks from experience

Box 7, Harrison, Miss., July 1st, 1916.

Mudge & Company, Railway Exchange, Chicago, Illinois.

Dear Sirs: I have now been using the "Wonder-Pull" outfit about two months, and am well acquainted with it. It is the best hand car outfit I have ever seen for converting old hand cars into motor cars, because the outfit is compact, sets in the center of the car and big holes do not have to be cut in the floor of the car for belts to run in or for fly-wheels to turn it. Another point in your favor is light weight. With my car equipped with your "Wonder-Pull" outfit, myself and three more men can take the car off the track anywhere without being strained to lift it. I have a car equipped with a 3 horse-power motor and it is much heavier to handle than my car equipped with the 6 horse-power "Wonder-Pull." Note also that the "Wonder-Pull" gives me twice as much power. This is a big item to section and bridge men who operate cars in obscure places, and any man who has used a motor car knows that it is desirable to get all the power he can at the least weight. The engine is fine and has given splendid performance. Take it altogether, I am well pleased with the outfit and do not think its equal can be purchased for the money. A good running push car I use for a trailer does not seem to affect the engine, as we can go at a speed of 20 miles per hour with a trailer and 15 men and tools. Our speed limit for motor cars being 15 miles per hour, is easily made with a loaded trailer or with the motor car without trailer and the throttle nearly closed. The motor also makes splendid headway against heavy head winds that would slow down some cars. In fact, I find your "Wonder-Pull" outfit much better for pulling loads than for speed. Everyone who has seen my outfit considers it the best converted hand car outfit on the road. With best wishes for your success, I remain,

Respectfully yours, J. A. ROSE, Y. & M. V. Ry.

Your Old Pump Cars

The good service still left in your old section hand cars might well be utilized. It can be.

The wheels on many give promise of long mileage. The axles are sound. The decking and under sills are in good shape. If you have the foreman take off the handle bars, bull gear and gallows frame, there is left a first-class foundation for your new motor car.

You can now ship to him direct from factory a

MUDGE "WONDER-PULL"

SECTION MOTOR CAR TOP ASSEMBLED

It is not necessary to take the work into your shop. The foreman places the "Wonder-Pull" in center of car. Up through the car sills and lower rail of "Wonder-Pull" (see cut) come six long bolts—nuts on top. Split pulley is placed on axle—belt is laced—tank is filled and she fires her first shot with a bang that means business.

Simplicity is the keynote of the "Wonder-Pull's" success. It is completely assembled in its frame before leaving the care and tests of our expert motor car men. Not one item of material is furnished by your foreman. It is ready to mount on hand or push car. It is 6 ft. long, 28 inches wide and weighs 300 lbs.

Engine is six horse—two cycle—*air cooled*. There are three moving parts. A track man having had no experience with engines finds the "Wonder-Pull" a reliable, trustworthy success in his unskilled hands.

Let us tell you of the service you can expect and what others say about it. Write for specifications.

Mudge & Company

Railway Exchange, Chicago

Railway Maintenance Engineer

Volume 12 August, 1916 Number 8

(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age Gazette* and *Railway Engineering and Maintenance of Way.*)

Published on the last Thursday preceding the date of issue by the
SIMMONS-BOARDMAN PUBLISHING CO.,
TRANSPORTATION BUILDING, CHICAGO, ILL.

NEW YORK: WOOLWORTH BLDG. CLEVELAND: CITIZENS' BLDG.
LONDON: QUEEN ANNE'S CHAMBERS, WESTMINSTER.

EDWARD A. SIMMONS, *President.* LUCIUS B. SHERMAN, *Vice-President.*
HENRY LEE, *Vice-President and Treas.* W. H. WIUM, *Secretary*

ELMER T. HOWSON, *Editor.*
WALTER S. LACHER, *Associate Editor* JOHN G. LITTLE, *Associate Editor*

Entered at the Post Office at Chicago, Ill., as mail matter of the second class.

Subscription price, including the twelve regular monthly issues of the *Railway Maintenance Engineer* and the four daily issues of the *Railway Age Gazette*, published in connection with the annual convention of the American Railway Engineering Association: United States, Canada and Mexico, $1.00; foreign countries (excepting daily editions), $2.00.

WE GUARANTEE that of this issue 5,200 copies were printed; that of these 5,200 copies, 4,251 were mailed to regular paid subscribers, 74 were mailed to advertisers, exchanges and correspondents, and 875 were provided for new subscribers, copies lost in the mails and office use.

The *Railway Maintenance Engineer* has applied for membership in the Audit Bureau of Circulations.

CONTENTS

EDITORIALS 225
LETTERS TO THE EDITOR:
A TRIBUTE TO THE ROADMASTER 227
UNIT COSTS 227
NEW BOOKS 228
MAINTENANCE METHODS ON THE B. R. & P. 229
SLOW ORDERS AND HAND SIGNALS 235
A SUGGESTED PROGRAM FOR TRACK WORK; W. F. RENCH 236
THE MADDEN RAIL LAYER 237
COMING CONVENTIONS 238
OPERATING CONSTRUCTION EQUIPMENT 239
QUICK WORK PREVENTS FLOOD DAMAGE 241
SIMPLIFYING SECTION FOREMEN'S REPORTS; KENNETH L. VAN AUKEN 242
A LARGE ROADSIDE TANK; C. R. KNOWLES 243
A NEW USE FOR A TRACK JACK 244
CUTTING BRUSH AND WEEDS; E. F. PETRY 244
CRUSHED GRAVEL BALLAST ON THE ROCK ISLAND 245
REDUCING TRACK TOOL EXPENSES; M. E. CARROLL 246
SPECIFICATIONS FOR CONCRETE AGGREGATES; CLOYD M. CHAPMAN 248
GENERAL NEWS DEPARTMENT 249

When visiting his gangs the average supervisor ordinarily devotes practically all of his attention to the methods of conducting the work and little or none to the kind and condition of the tools the men are using. While the consideration of methods is essential, the importance of the equipment of the gangs should not be overlooked as, especially under the present unusual conditions existing in the steel industry, the amount of money involved in tools is large. For this reason every effort should be made to secure full results from them. This involves a knowledge of their limitations and of the proper methods of using them. It is in this respect that most employees are deficient. It is nearly always easier to use a tool correctly than incorrectly, and most of the abuse results from ignorance. Careful attention to the training of the men in the proper ways of using the different tools and in the results of abuse will do much to reduce the expense of this item and will contribute largely to a decrease in personal injuries.

The Proper Use of Tools

Because of the ever-increasing difficulty in holding experienced men in the maintenance of way department, any step which will help overcome this condition is of general interest. For years it has been common practice for supervisors or foremen to summarily dismiss subordinates from the service without the formality of a hearing and the men have frequently suffered from the spleen of employing officers whose only limitation in the matter of dismissals has been their ability to obtain substitutes. To correct the abuses of this system and to instil in the minds of the men a sense of security in their positions, the chief engineer of the Buffalo, Rochester & Pittsburgh has put into effect a plan whereby a man in the permanent employ of the company cannot be discharged without a full investigation. The order and its application, which are described elsewhere in these columns, guarantee fair treatment to the men of the engineering and maintenance of way department, and make it impossible to remove men from the service permanently without the sanction of the chief engineer. The plan further prescribes that for minor offenses discipline is applied by record and that the men are given an opportunity to clear their records. The system is similar to that followed successfully for the men in the train service on a number of roads and places the men of the engineering department more nearly on a plane with those who are organized and protected from summary dismissal by their agreements with the railroads on which they are working.

The Discipline of Maintenance of Way Forces

The recent narrow escape of a passenger train from serious accident resulting from a derailment caused by track which had buckled on account of the heat on an important main line, brings to attention the rapidly increasing practice of materially reducing, and in some instances of entirely eliminating, the allowance for expansion in laying rail. Starting four or five years ago, a considerable number of roads have very materially reduced the allowance for expansion formerly provided, depending upon the heavier sections of rail to absorb the expansion stresses created by the heat. Not all the roads which have taken

Laying Rail Without Expansion

this action have anchored their rail adequately and it has run considerably in some instances under traffic. As a result, the combined stresses created by the running of the rail and by expansion frequently become very high and it is not surprising that the track buckles, particularly if the bolts are so tight that the rail cannot adjust in the joints. The reduction of the allowance for expansion to the lowest practicable limit is desirable as a means of conserving the rail, and this limit can safely be set lower with track well anchored than with unanchored track. At the same time, the entire elimination of all expansion without the adoption of means to keep the rail from moving under traffic is open to serious question. It would at least seem advisable to adopt a conservative policy on those lines having high speed passenger traffic until the safety of this practice has been demonstrated on freight lines or on tracks handling passenger trains only at moderate speeds.

ECONOMICAL WATER SERVICE

ONE common result of inadequate attention to water service is blind adherence to standard equipment without a realization of the fact that a type of plant well adapted to certain conditions may be entirely uneconomical at other points. While it is much easier and does not require any special knowledge to specify a certain standard type of equipment for all water stations, the failure to consider local conditions in this manner cannot help but result in the installation of inefficient plants in a large proportion of the places.

As an example of the lack of realization of this fact, only a short time ago an officer of a large road was asked for his recommendation regarding the type of pump which should be made standard on that road. To arrive at his recommendation he ascertained the cost per thousand gallons of water pumped at each station on the road equipped with each of the several pumps under consideration, averaged these costs for each type of pump and recommended the one showing the lowest cost without giving any consideration to the local conditions under which the different pumps were working. In marked contrast with this condition is the practice on an adjoining road where a detailed study is made at each station at which improvements are contemplated and every request for an expenditure must be accompanied by a carefully prepared estimate of the savings in operation which this expenditure will create. A study of this fact led to the recent installation of a 25-hp. plant at one station which has made possible the pumping of all the water required in 4 hours per day as compared with 10 to 12 hours' operation previously, saving about $40 per month in the pumper's salary alone. Savings of this nature when multiplied many times over a system exert an important effect on the total cost of this branch of railway operation.

However, the installation of the proper type of equipment alone is not enough. One road which has failed to give the water service department the same particular attention recently that it gave it some years ago, has found that the cost of pumping the water has practically doubled within the last few years because of the discontinuance of the supervision over the operation of these plants. Continued trained supervision, both in the selection and installation of new equipment and of its operation, is necessary if the most economical results are to be secured. While the total expenditures are not so large as in a number of other branches of railway operation, they are of sufficient size to deserve attention and the proportion of the total expenditures which it is possible to save is as large as can be secured elsewhere.

ADEQUATE SUPERVISION

ONE fact which stands out prominently in the maintenance of way organization of the Buffalo, Rochester & Pittsburgh, described in another column, and which was also noticeable in the Lehigh Valley organization, described two months ago, is the detailed supervision which these forces receive. The problem of providing adequate supervision for men scattered over every mile of a line is a difficult one, but this very condition makes added supervision necessary.

The amount of money spent annually under the direction of the average section foreman exceeds $5,000 and that under a roadmaster's jurisdiction varies from $150,000 to $200,000. In spite of these relatively large amounts involved, frequently a foreman does not see his superior officer except on the rear end of a passing train for weeks at a time, likewise on many lines a roadmaster is left largely to himself so far as supervision is concerned, reporting to an officer less experienced in track matters than he is.

One of the greatest handicaps in the economical conduct of maintenance of way work is the lack of supervision all the way down the line. The chief engineer or other officer in charge of maintenance of way on a system of 8,000 to 10,000 miles is not able to study details and he is not given a sufficient number of assistants to enable any of them to concentrate on these relatively detailed but, nevertheless, important problems. This condition prevails throughout the entire organization. A roadmaster is given charge of 150 to 250 miles of busy main line or an even greater mileage of branch line, making it impossible for him to visit each foreman as he should to discuss the work with him and to give the foreman the benefit of his broader experience. While it is true that the Buffalo, Rochester & Pittsburgh and the Lehigh Valley are both roads of relatively limited mileage, if this close supervision is worth while there, it will be of even greater value on roads of larger mileage. It is only when we secure more nearly adequate supervision that we have truly efficient and economical maintenance.

CONCRETE MATERIALS

CURRENT literature in the technical journals, the proceedings of the engineering societies and the reports of experiments contain a wealth of information on the influence of the character of the sands and coarser aggregates on the strength and durability of concrete. The need of clean, hard, durable materials for the production of good concrete has long been appreciated, and for a decade or more there has been a common understanding that the relative density of the concrete, as affected by the grading of the particles used, bears a more or less definite relation to the strength. However, it is only in recent years that this subject has received the attention it deserves and a multitude of experiments have disclosed the complexity of the subject, although bringing us ever closer to the truth.

We are now beginning to understand upon how many conditions the strength of the concrete is dependent. Notwithstanding this fact, it is still the practice, particularly in railroad work, to specify definite proportions for the ingredients of the concrete by relying on a more or less definite specification for the sands and coarser aggregates to obtain materials of a sufficiently standard character to insure good concrete, the proportions of the ingredients being sufficiently generous to insure a concrete of sufficient strength no matter how much the volumetric make-up of the sand and gravel may vary from that necessary to produce concrete of the maximum strength. In the case of concrete placed by company forces it is

possible to sail somewhat closer to the wind with the proportions, depending upon the experience and judgment of the foreman, who varies them when he detects by observation of the mixed concrete that they are not what they should be.

Such methods are approximate and uneconomical at best, and, as pointed out in an article on another page of this issue in contract work they place a premium on the use of the poorest material which will pass the specification. If, instead, an attempt is made to determine by actual tests the proportions necessary to obtain just the strength of concrete required for a given class of work with the materials at hand, it will frequently be possible to make use of the materials most readily available which would otherwise be eliminated by a regular specification, while, on the other hand, with the best of sands and coarse aggregate it will be possible to obtain the desired results with a smaller proportion of cement.

THE SEASON OF CONVENTIONS

With the season for the maintenance of way conventions, other than that of the American Railway Engineering Association, drawing near, it is well to consider the opportunities they offer for the promotion of modern methods of conducting work. The Roadmasters and Maintenance of Way Association will meet at New York on September 19 to 22. The American Railway Bridge and Building Association will hold its convention at New Orleans on October 17 to 19 and the Maintenance of Way Master Painters' Association will convene at Philadelphia the same week. These three associations cover all the major activities of the maintenance of way department from the standpoint of the field forces. The first two mentioned conventions are each attended by 300 to 400 men interested in their respective branches of work, the Master Painters' Association being somewhat smaller. These men spend three to four days in active discussion of live problems connected with their duties and exchange much practical information. It is self-evident that the free exchange of ideas by men of long experience, employed on a large number of roads in all parts of the country will bring out a great deal of valuable information. There is also much to be gained from the enthusiasm which a meeting of a large number of men with common interests creates. The standards of work of each of these associations has been raised materially within the past few years until they are now attended by a considerable number of higher engineering and maintenance of way officers who find the information brought out in the discussions and reports of practical value to them. This has been particularly true of recent conventions of the Bridge and Building Association.

Many roads arrange for their supervisors and engineers to attend these conventions regularly and some general officers write their men urging them to go. Some roads pay the expenses of their men to these conventions, feeling that the increased efficiency and enthusiasm of the men make such expenditures a good investment for the road. In this day when more scientific methods are being developed rapidly, when increased demands are being made upon the track and structures and when the scarcity and decreasing efficiency of labor are so acute an officer in charge of maintenance of way should have all the information available and should be able to benefit fully from the experiences of other roads in order to perform his work for his road to the best advantage. If it is at all possible for a supervisor or an engineer to get away from his division for a few days he will find the time spent at these conventions well worth while, for he will gain many practical ideas.

LETTERS TO THE EDITOR

A TRIBUTE TO THE ROADMASTER

Hillburn, N. Y.

To the Editor:

For many years one has seen volumes written regarding the duty well done of public servants and individuals in almost every walk of life. Only a short time ago glowing tributes were paid to a master mind in railroad building. We have also read many articles regarding different organizations in the railroad service, but one has seldom seen a line written which has done justice to a class of men who are constantly giving their entire thought and devoting all their energies to their duty—the roadmasters and supervisors. Possibly this is because they are unassuming and firmly believe that the work set before them must be done and that no credit is due them. It may also be because they consider themselves part and parcel of the railroad organization to which they belong.

Let us look for a moment at their record and see what they are called upon to perform from day to day, week to week and so on throughout the years. The duty of a roadmaster or supervisor is to oversee the division of which he has charge. He must know that the roadbed under his care is in perfect condition, and sometimes he keeps it so when little material is forthcoming for the purpose of maintaining his track. In stormy weather he must be ever alert and watchful. There are times during the winter months when for days he never enters his home. Sometimes we find trouble along the line in other branches than the maintenance of way department, but one will always find the roadmaster faithful to his trust.

Presidents of railroads have risen from roadmasters and supervisors. We have many general managers and hundreds of superintendents who have risen from that rank, another proof of the caliber required in a roadmaster to oversee and maintain tracks over which millions of tons of freight and hundreds of thousands of passengers are carried in safety. W. C. K.

UNIT COSTS

Baltimore, Md.

To the Editor:

One of the effective devices by which present day manufacturers keep in touch with the situation in their plants is to require a daily or monthly record of the unit costs of the various parts which go to make up the finished product. A comparison of the results for two periods will indicate at a glance a gain, a loss or no change.

It may be claimed that maintenance of way work can in no wise be compared to manufacturing. It is perfectly true that maintenance as a whole is never completed and there has never been devised a unit of comparison such as the cost to maintain one mile of track which can logically be used to compare one year with another to show the real economy of maintenance. This difficulty seems to have effectually postponed the development of comparative cost systems for track work. On the other hand, manufacturers have been forced for self-preservation to develop cost systems for single products and the parts and operations going into those products. Certainly most railways also have found it necessary to economize in track work, and the writer believes that to do so intelligently the practice of recording the cost

of applying the various elements of track furnishes the first essential.

The principal track maintenance operations are: Applying ties, rails, ballast, frogs, switches, guard rails, tie plates and anti-creepers; surfacing, gaging, lining, cleaning ballast, respacing ties, tightening bolts and unloading cinders and refuse. It is not far wrong to say that varying with the season the above items will cover from 60 to 90 per cent of the total hours. Hence a record of all or even a part of these operations will enable the management to keep a good check on performance and to call on this section or that division to produce a better output.

The simplest method of comparison is in terms of hours, which overcomes the objection that different rates may be paid in different districts, or that rates may be varied from time to time. An illustration of this would be a report from a foreman that on May 10, 64 ties were installed in stone ballast in 80 hrs., or at the rate of 8 per 10 hrs. The factor of varying density of traffic and different distances to travel from the tool house to work may be conveniently covered by allowing a different credit percentage for each section.

It is not supposed that records like this can be kept without any cost. By using daily reports with printed headings for the principal track operations, the foreman would furnish the basis of the records and some person would be required to tabulate them in the roadmaster's or division engineer's office. It is not difficult for foremen to keep the time of performing the various kinds of work. Omitting yard sections, the usual foreman's daily time report contains from two to four entries for work done.

Even if the cost of such records was much greater than experience has shown it to be, it would be better to expend the money than to operate in the dark and merely trust that the roadmasters are getting the best performance possible. The difference in unit costs, frequently found to be the result of more economical methods on certain districts, would point the way to further economies.

If maintenance of way work had in the past been done for profit on a competitive basis it seems probable that such unit costs would have been developed some time ago. The complaints of additional clerical work and red tape are largely a case of "crying before being hurt," for with modern office methods using computing machines, slide rules, duplicating machines and patent indexes, office work is made vastly cheaper.

Surfacing may be reported as ties tamped, each end of a tie being reported as one tie, while separate headings may be used for surfacing low joints and surfacing out of face. Gaging and shimming may be reported the same way, each end of a tie to count as one tie. Applying anti-creepers and tie plates may be reported as the number applied and the hours spent.

Maintenance of way men often say that such records may readily be kept in machine shops, but that track work is different and therefore detail comparative records are impossible. This is hardly the case. Even in machine shops such records are not easily kept, but are recognized to be of value and are kept in spite of this difficulty. Briefly, some of the features making the accumulation of these records difficult are: The varying overhead expense in different departments; similar variations in the cost of power used; the cost of spoiled and rejected parts; variations in the quantity manufactured, and sequence of operations performed on different machines at different rates of pay.

It is common to see maintenance of way expense given per mile of all tracks or per mile of main tracks or per million revenue ton miles. In each case only one side of the transaction is covered, viz., the cost, while the amount of work performed, a factor equally important, is lacking. The nature of track renewal work, therefore, is such that to measure the real economy of performance it is necessary to know the number of each of the principal items of work and the time or cost required to perform them.

W. C. NISBET,
Baltimore & Ohio.

NEW BOOKS

Rail Failures. By A. L. Davis, office engineer, Illinois Central. Bound in board. 155 pages, 4 in. by 6½ in. Illustrated. Published by Hall-Stockton Printing Company, Chicago. Price $1.00.

This book was prepared primarily to assist trackmen in making reports of rail failures, such as are made on the standard form prepared by the rail committee of the American Railway Engineering Association. The first 11 chapters are devoted to a brief description of the properties of steel as influenced by the various ingredients and impurities and the processes used, and to the manufacture of iron and steel, with special reference to rails. The practice of typical rail mills is treated at some length. Chapters 12 to 19, inclusive, are devoted to descriptions of the various kinds of rail failures as they have been classified, with explanations of the causes of each as they are now understood, including outlines of the several theories for the causes of transverse fissures. The remainder of the book is devoted to the specifications of the American Railway Engineering Association for both Bessemer and open-hearth rail and modifications of these specifications to include the chemical analysis of finished rail and the nick and break test, as well as an account of tolerances and the practice of various mills as to branding and stamping. The book is written in non-technical language and will prove valuable not only in its primary object, but as a source of general information on the subject of rail manufacture and failures. An appendix is devoted to tables of the dimensions of various rail sections.

Structural Timber Hand Book on Pacific Coast Woods. By O. P. M. Goss, consulting timber engineer. 290 pages. 5½ in. by 8 in. Bound in leather. Published by the West Coast Lumberman's Association, 1016 White building, Seattle, Wash. Price $1.00.

With the rapidly increasing use of Douglas fir, western red cedar, western hemlock and Sitka spruce, there has arisen a demand for accurate information concerning these timbers and their physical characteristics. This book has been prepared to supply the information required by users of these classes of timber in construction work in addition to a large amount of tabular data of value in designing work. The book is well prepared and edited and contains much information concerning these Western timbers and the work for which they are suitable, either in their original state or treated. The book opens with a description of the various botanical species of Pacific coast woods, followed by tables giving a summary of the mechanical and physical properties, taken from the United States Forest Service publications. The grading rules are given, with an explanation of the relation between strength and density of Douglas fir. Several pages are devoted to a review of the latest data on the methods and effect of treating this wood with creosote oil. Nearly 200 pages are devoted to tables of safe loads on beams and columns, covering all ordinary sizes of sticks, span lengths, etc. The last few pages are devoted to miscellaneous uses for timber with some cost data. This is a valuable work, which should be on the desk of every engineer engaged in the design of structures involving the use of timber.

MAINTENANCE METHODS ON THE B. R. & P.

Close Supervision, Comprehensive Standards and a Thorough System of Inspection Bring Results

Station Grounds at East Salamanca, N. Y.

ALTHOUGH a road of relatively small mileage in a highly competitive territory, the Buffalo, Rochester & Pittsburgh is maintained to unusually high standards and with more than the ordinary degree of efficiency. This is accomplished primarily by close, systematic supervision of all details of the work by the general and local maintenance of way officers. In contrast with the divisional form of organization employed successfully on the Lehigh Valley and described in the June issue, the departmental organization is in effect on the Buffalo, Rochester & Pittsburgh with similarly satisfactory results.

This road operates 586 miles of line with 208 miles of second main track and 1,168 miles of all tracks and extends from Buffalo and Rochester, N. Y., south to Butler, Pa., with connections into Pittsburgh and New Castle, Pa., over the Baltimore & Ohio and with branches into the bituminous coal fields south of Punxsutawney. The freight traffic density is approximately 3,250,000 ton miles per mile of line, and the passenger traffic density approximately 100,000 passenger miles per mile of line. Approximately two-thirds of the freight traffic consists of coal moving north to Buffalo and Rochester, a considerable part of which crosses Lake Ontario by car ferry into Canada. With the exception of about 700,000 tons of iron ore moving southward from Buffalo, the remainder of the freight business consists of high class merchandise of various kinds. For operating purposes the road is divided into two divisions in addition to the terminal divisions at Buffalo, Rochester and New Castle.

The Engineering Department

The chief engineer is in charge of all maintenance of way and construction work, reporting directly to the president. All subordinate officers in this department report directly to the chief engineer or his assistants without reference to the local division operating organization. All problems originating in the engineering department of common interest to two or more departments are referred to the chief engineer who handles them direct with the head of the other department concerned.

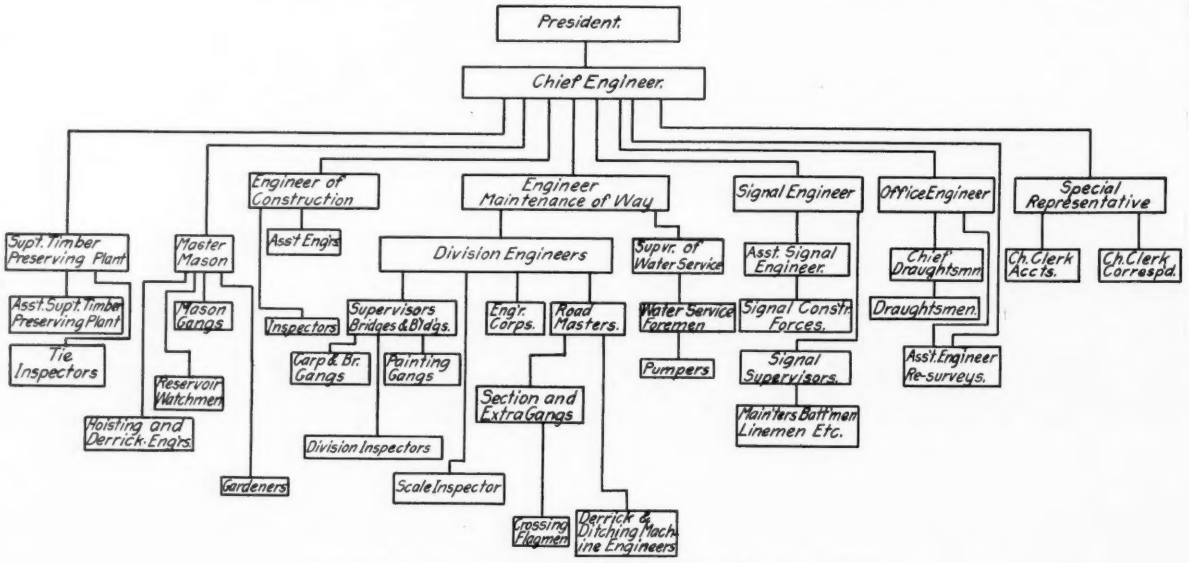
Assisting the chief engineer are the engineer of construction, the engineer maintenance of way, the signal engineer and the office engineer. The superintendent of the timber preserving plant, the master mason and a special assistant also report directly to him. Reporting to the engineer maintenance of way are two division engineers, to whom report the roadmasters and supervisors of bridges and buildings. Each division engineer is also given an engineering corps of sufficient size to handle the routine engineering work other than on new construction of magnitude which is handled directly by the engineer of construction and his forces. The supervisor of water service reports directly to the engineer maintenance of way, independent of the division engineers, although cooperating with them. This is also true of the master mason, whose gangs report directly to him; he in turn reports directly to the chief engineer as noted above. With these exceptions, all maintenance of way forces report to the division engineer on whose territory they are working. The work in connection with Federal valuation is in direct charge of an assistant engineer, reporting directly to the chief engineer through the office engineer. A special office and field force is assigned to this work.

As an aid to the efficient conduct of work out on the line, close attention has been given to the office organization. One common file is maintained for the chief engineer and his staff. Two carbon copies are made of each letter written, one on white and one on yellow paper. The white carbon copies are attached to the file correspondence, while all the yellow carbons for each day are bound together and passed to the chief engineer, the engineer maintenance of way, the signal engineer, the office engineer, and the chief clerk, who read them and check each letter with their distinctive colors. In this way the heads of these subsidiary departments are kept fully informed regarding the work being done in the entire engineering department, much inter-department correspondence is eliminated and departmental lines are kept down.

An important unit in the office organization is the office engineer and his staff, who have charge of all office records, the preparation of plans for new work, etc. Special attention is given to the maintenance of accurate map records in the general office. As any improvement work in the field is finished the officer in charge is required to make a complete report, accompanied by a blue print of the plan, corrected to show the work as actually

built. The office tracings are then revised accordingly. Large maps to a scale of 30 ft. to 1 in. have been made for all terminals showing the water systems, blue prints of which are framed and placed in the principal shop buildings and offices for ready reference; smaller maps of each water station, showing all physical features such as tanks, standpipes, piping, etc., are provided, complete sets of which are furnished in blue print form to interested officers. Complete records are also kept of all sidings, main track rail, ballast, drain tile and fences, and the maps and charts are revised monthly, all division and general officers having complete revised sets of these prints. All right of way records are kept in the chief engineer's office, although purchases and sales are negotiated by a right of way agent acting in conjunction with the engineering department but reporting direct to the president.

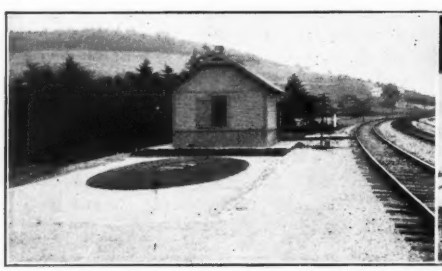
All accounting for engineering department expenditures is done in the chief engineer's office. All time books are sent through the division engineer's offices to the chief engineer, and all payrolls are made up there. The distribution of all charges is made in the manner and the detail required by the auditing department, and only the totals for the different items are given to the auditor. From the direct knowledge of the manner in which the work was handled in the field, the engineering department is able to distribute the charges to their proper accounts more accurately and also to do the work quicker. It is seldom that all the charges for a piece of work are not in and distributed within 30 days of the completion of the project. The handling of the accounting in this office also gives the engineering department an opportunity to prepare cost data which are valuable for estimating purposes, and also in the economical conduct of later work. To insure uniformity of practice in the collection and distribution of these charges, all division maintenance of way officers and their clerks meet with the engineering accountant every three months to discuss methods, new rulings, etc.



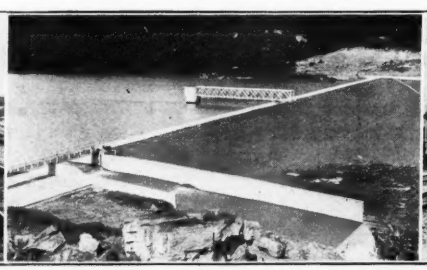
THE ORGANIZATION OF THE ENGINEERING DEPARTMENT.

In connection with the Federal valuation of the property, a resurvey of the entire line is being made, at which time the original center lines and all property lines are run out and established. Concrete monuments are being placed in the present center line of the track in single track territory and midway between tracks in double track territory, at the beginning and end of all curves and at intervals of 1,000 ft. on tangents, and all surveys are referenced to this monumented base line. Monuments are also placed at all right of way line intersections, concrete monuments being used through cities, villages, etc., and treated timber stakes through outlying territory.

Close attention is paid to the appearance of the property, particularly about station grounds. By the exercise of care in designing the buildings and in laying out the grounds in harmony with them, unusually attractive effects have been secured with slight additional expense. Practically all of the newer stations are of brick or concrete construction. The maintenance of station grounds is in charge of the roadmaster, the master mason, how-



A TOOL HOUSE.



ONE OF THE RESERVOIRS

ATTRACTIVE STATION GROUNDS.

ever, handling all landscape gardening work. Beyond the station grounds, similar attention is paid to the removal of all debris and waste materials. The foundations of all signals and signs are graded and dressed to standard dimensions, paved with cobble stones and the slopes sodded. Metal and concrete roadway signs are used almost entirely.

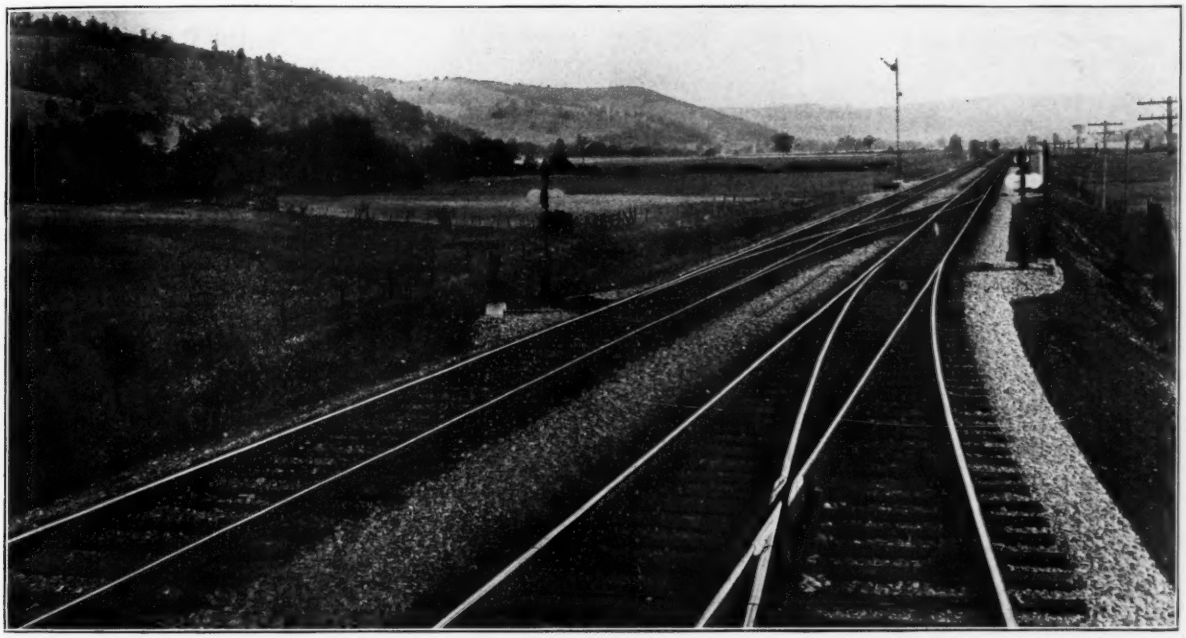
Standards

Few roads have prepared as complete a set of standards of design and construction as well as of methods of performing work as the Buffalo, Rochester & Pittsburgh. With the idea that the trained officer of wide experience is better able to determine the best way to perform work and to develop economical methods than the foremen on the job, the chief engineer and his staff devote a great deal of time to this subject. They have prepared unusually complete standards for much of the routine work while every plan for reconstruction work involving special problems contains a detailed schedule of operations which is worked out carefully for the guidance of the foremen in the conduct of the work. The standards are printed on sheets of uniform size for convenience in binding and filing. Each foreman is provided with a complete set of the standards for all work coming under his direction and he is held responsible for the performance of his work according to them. These standards are revised annually to keep them up-to-date.

All foremen are also provided with books, in which they file for reference all circulars received by them. To insure that these books are kept up-to-date, the foremen are required to send them to their superior officers every two months, where they are checked. The file copies in these offices are in turn sent to the general offices for checking at similar intervals. These books do not become the personal property of the foremen, but a man is required to hand his copy over to his successor. To insure familiarity with the instructions, the men are examined on them at frequent intervals.

All foremen are also provided with books showing the prices of all materials used by them. By informing the men in this way on the costs of materials they are using, it is believed that they are encouraged to become more economical in their use. All foremen are also provided with speed tables enabling them to check accurately the speed of trains as a curb against reckless running. In addition, men from the engineering department are sent out at intervals during the winter to check the speed of trains. All instances of excess speed reported are taken up with the transportation department for action.

Approximately one-half of the foremen and nearly all of the laborers are foreign. A few apprentice foremen are also employed. These men are recruited from the gangs and also from the outside. They are placed under the more capable foremen for instruction and are paid 20 cents per hour for the first three months of service, $55 per month for the next three months, and $60 per month thereafter until such time as they are placed in charge of sections.



Standard Main Line Track and Roadbed Construction.

The track is laid with 90-lb. and 100-lb. A. S. C. E. rail placed with the brand out. Insert type manganese frogs are employed in busy yard tracks and in all but the highest speed main tracks with manganese switch points on the turnout side. All rail is thoroughly anchored as laid and the ties are spaced. A heavy renewal of ties is made at the time rail is laid to avoid the disturbance of the track the following year. At other times the ties are spotted in as their condition demands. Stone ballast is applied wherever new rail is laid, the track is brought up to grade, and heavy Goldie shoulder tie plates are applied to all ties at the same time. All new ties are also provided with tie plates when inserted. In addition all turnouts are tie plated and the old plates released from main tracks, are used in yard and side tracks. It is the plan to have all the ties in main tracks, on both curves and tangents, fully plated. Switch ties are "spotted in" unless 50 per cent or more of the ties in a set require renewal, when the entire set is replaced.

As fast as possible all cuts are being under-drained. From 40 to 50 miles of 6-in. drain tile is being laid each year, preference being given locations at which ballasting work is planned. The tile is being laid 4 ft. below the surface and is supported on boards to hold it in line, the

trenches being back filled with coarse cinders above the tile.

With highly-developed standards of materials, it is natural to expect a systematic program of work. As far as possible all work is handled according to a definite schedule and is undertaken on all sections simultaneously. This program is established by circulars issued from time

CONCRETE SIGNAL TOWER CONSTRUCTION.

to time, and, in addition to promoting uniformity, has been found to give a measure of performance for the different sections. In brief the program provides that, as soon as the frost leaves the ground, the forces begin clearing up the property, opening ditches, removing shims, surfacing and lining, and putting the track in good riding condition. They then oil and tighten all bolts and drive down the spikes over the entire section, after which they take up the heavier track work. About July 1 they begin weeding and mowing. Later in the fall the bolts are again oiled and tightened as the track is prepared for the winter. Where the regular foreman is capable, he is given sufficient men to handle the heavier work, other than rail renewal and ballasting, on his section. On other sections extra gangs are sent in.

METHODS OF WORK.

The track-walkers are held responsible for the maintenance of all switch and signal lamps. Although long-time burners are used, the men are required to examine the lamps daily and to report to their foreman any that are burning improperly, being disciplined for failure to make such reports. The foremen transmit these reports to the roadmasters, who keep book records of them. The roadmasters and signal supervisors are also required to ride over their territories at night once every two weeks to note that the lamps are burning and to report any failures. A comparative statement of lamp failures by divisions is made monthly to encourage their proper maintenance. By these measures the number of lamp failures has been reduced 90 per cent in recent years.

All ties are purchased directly by the superintendent of the timber preserving plant, who has three inspectors stationed in the producing areas, reporting directly to him. About 80 per cent of the ties received are beech and maple. All main track ties are treated before being placed in the track and are grouped before treatment, beech being treated to refusal and other woods except pine being given 12 lb. of oil per cu. ft. of timber. Pine is given 10 lb. of oil per cu. ft. All ties are thoroughly air-seasoned before treatment. At the present time about 650,000 ties, or 47 per cent of all those in the main track, are treated. Every tram of ties is weighed before and after treatment to ascertain the amount of oil injected. As a further check on the thoroughness of treatment, one tie of each class of timber is sawed in two and two are bored with an increment borer every week and the samples sent to the chief engineer.

The ties are laid in the track with the sap side up, and to insure this being done, a nail with a letter depressed in its head indicating the kind of wood is driven in the sap side of the tie at the treating plant. A dating nail bearing the year in depressed figures is driven in each treated tie by the trackmen when it is placed in the track. An independent inventory of the ties on hand at the treating plant and stored along the line is made by the chief engineer's office every three months to keep a close check on the supply.

A STANDARD TRACK-WALKER'S OUTFIT.

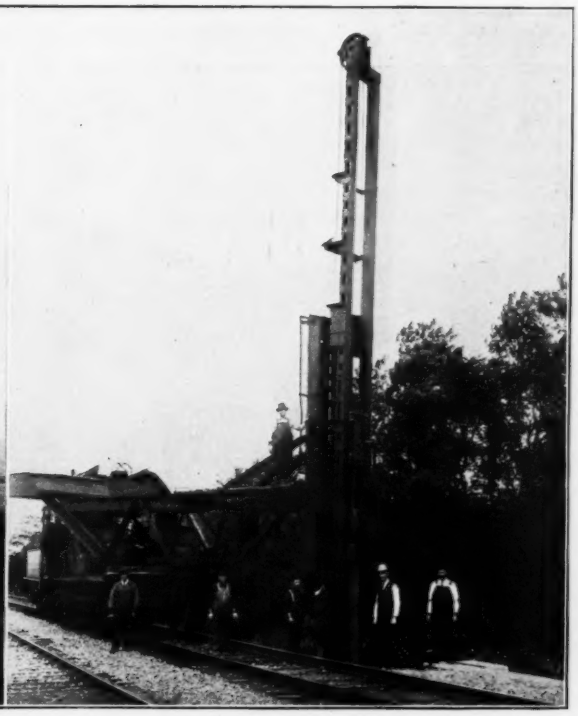
STANDARD PRACTICE IN RENEWING TIES.

To secure uniformity of practice and to prevent their removal from the track prematurely, while at the same time insuring the removal of all decayed ties, they are examined by inspectors, who indicate those which are to come out each season. Four inspectors, selected from the more experienced foremen and reporting to the division engineers, are assigned to definite territories and

work back and forth on the track throughout the season, not only indicating the ties which are to be removed, but also noting and reporting any improper practices in the conduct of track work.

As soon as the frost is out of the ground in the spring these inspectors go over one mile of track on each section carefully, to indicate the ties to be renewed so that the foremen can get started on tie renewals. After going over their entire territories in this way they drop back and complete their inspection of the main tracks and sidings. The section foremen accompany the inspectors over their respective sections, calling to their attention any ties which they may have missed and which the foremen believe should be renewed. Where track is to be ballasted heavier renewals are made, the inspectors being advised beforehand where such work will be done.

Unloading a Frog with a Magnet.



A Pile Driver at Work.

Section foremen are required to fill out cards daily showing the number and kind of treated ties placed in each mile, and also indicating the tracks in which they were placed.

In taking treated ties out of the track the section foremen are required to fill out cards daily showing the number, character and age of the ties, the points from which they were removed and the reasons for their removal. After these cards are approved by the roadmaster they are forwarded to the chief engineer for his records. Goldie tie plates and pointed spikes are used exclusively. All ties are adzed to templates when relaying rail before the new rail is applied and the exposed surfaces are given a brush treatment with creosote.

To establish uniform practice and to insure fair treatment for all employees, no man on the permanent forces, whether paid by the day or month, may be discharged or reduced in rank or pay (reductions in force, insubordination, intoxication or other causes requiring prompt action excluded) before a full report is made to the superior officer, with a complete statement of the employee's record. Before taking final action this officer must submit his recommendation to the chief engineer for approval and final decision. In this way a foreman or other employee has a security of position until his case has been passed on by higher officers, removing the danger of unwise or hasty action being taken by a local officer because of petty personal differences. For minor offenses discipline is applied by record without suspension, as far as possible, and employees are given an opportunity to clear their records by efficient service. A discipline bulletin is issued monthly and mailed to every foreman and higher officer. A copy is also posted in every tool and pump house along the line for the information of the men.

All accidents in the engineering department are subjected to special investigation and are also bulletined. A comparative statement of the injuries incurred by divisions is issued monthly. Likewise all derailments are investigated by a committee consisting of one representative each from the maintenance of way, mechanical and operating departments, who are able to determine the cause for nearly all accidents of this character and to recommend the proper remedy.

For the past two seasons tents equipped with steel bunks have been substituted for camp cars for the extra gangs with very satisfactory results. These tents are more sanitary and more easily moved from place to place as the work progresses than are cars. In general it is possible to establish a camp immediately adjacent to the work. This arrangement also permits a more flexible camp layout to accommodate gangs of different sizes. The tents have met with the general approval of the men, particularly because they are cooler on hot nights. Standard outfit cars, equipped with steel bunks, are provided for mason, track, bridge, signal and water service gangs. These cars and also all hand and tool cars, tool boxes and tools are distinguished by distinctive color boards to indicate their assignment to the mason, track, bridge, or water service divisions of the department.

While the construction of extensions is generally contracted, practically all improvement work along the operated lines is handled with company forces. For this purpose the road owns 2 steam shovels, 3 Lidgerwood unloaders with a complement of unloading plows, 1 Jordan spreader, 2 pile drivers, 3 locomotive cranes, 2 American ditchers and 100 specially-designed steel under-frame flat cars. Each roadmaster, supervisor of bridges and buildings, and master mason also has a steam derrick for the handling of rail and other materials, the throwing of rail onto the ground being strictly prohibited. During the summer working season each roadmaster has an assigned work train, with others as the occasion demands. During the winter months work trains are ordered only as required.

The road is now engaged in a comprehensive program of replacement of timber structures with those of steel and reinforced concrete, designed for Coopers E-60 loading. For many of the structures concrete slabs are is carefully graded, drained and paved. Every three years the steel hoops are removed from all wooden tanks and are scraped, examined, repaired if necessary and painted. At the same time the tubs are painted. By this plan the tanks are inspected and painted regularly, their life is increased, and the danger of failure is practically eliminated.

About 56 per cent of the main line mileage is equipped with automatic block signals and the entire system with telephone despatching circuits. Starting with the maintenance of this equipment, the signal forces have now taken over all electric service, including electric light and power equipment, and their inspection and maintenance is now handled directly by the regular forces. The signal lamps are maintained by the track-walker, who is also held responsible for the detection of broken bond wires. The track-walker, maintainer and battery man are all held jointly responsible for the proper bonding of the track.

THE CONCRETE PIPE PLANT AT EAST SALAMANCA.

erected on concrete piers. Four years ago there were over 300 timber structures on the northern divisions, practically all of which have now been replaced. Concrete decks are being applied to practically all structures up to about 110-ft. spans. All concrete work is placed by company forces.

A complete concrete post and pipe plant is operated at East Salamanca under the direction of the master mason. At this point all concrete culvert pipe, fence posts and similar materials required on the line are made. Telephone booths for use at outlying points, signal bases, etc., are also cast here as required.

During the last few years careful attention has been given to the development of adequate water supplies by the construction of large reservoirs formed by the building of earth and masonry dams across ravines. In addition to securing an ample supply of water at points where shortages have been encountered previously, the quality is improved, for much of the water through the oil and coal mining regions is unsatisfactory for boiler use. All these reservoirs have been built entirely with company forces.

The standard roadside tanks are of steel on steel posts for 100,000 gal. capacity and of wood on steel substructures for 50,000 gal. capacity. The ground below all tanks

A signal supervisor is located on each division with a corps of maintainers and battery men. The battery men make a daily report of all battery renewals, giving the location of each one renewed. A record is kept of renewals of all track, line and operating batteries and of all materials used in them. Counters are also attached to all signals and readings are taken at the end of each month, from which the number of operations per avoidable interruption is ascertained. A monthly bulletin containing these performances by divisions is then issued to encourage rivalry between the supervisors.

The maintainers are required to inspect everything in their charge every two weeks, making all repairs at the time of inspection, and to make out detailed reports in duplicate. As far as possible the supervisors accompany the maintainers on these inspections and sign the reports with them as an encouragement to thorough inspection.

As a means of instruction of the men, meetings of the foremen, battery men and maintainers and track-walkers, respectively, are held at intervals to discuss their problems and the methods of performing their work. The meetings of the section foremen are held at different points on the roadmaster's districts to give the men an opportunity to see the other men's track. During the summer when it is difficult for many of the men to leave

their work lists of 20 to 25 questions are sent to them monthly to answer. The replies are forwarded to the chief engineer's office, where they are corrected and any errors called to the attention of the men. In this way they become more familiar with the standards of the road and with the methods of conducting work. A book of rules prepared in conversational form and containing about 4,000 questions and answers relating to all branches of maintenance of way work is now being completed. This book will be distributed to all the officers, foremen, crossing watchmen and flagmen, who will then be examined on it at intervals.

Handling Materials.

A monthly requisition meeting is held at a central point, attended by all division officers, to discuss the materials needed during the next month, the possibilities of transfers, etc. The requisitions are brought to the meeting in pencil form and are discussed in detail, the purpose being to encourage the division officers to do their own ordering carefully, rather than to have the general officers cut down the requisitions later. After the meeting the division officers make out their revised requisitions and forward them through the division engineers' offices to the chief engineer for approval.

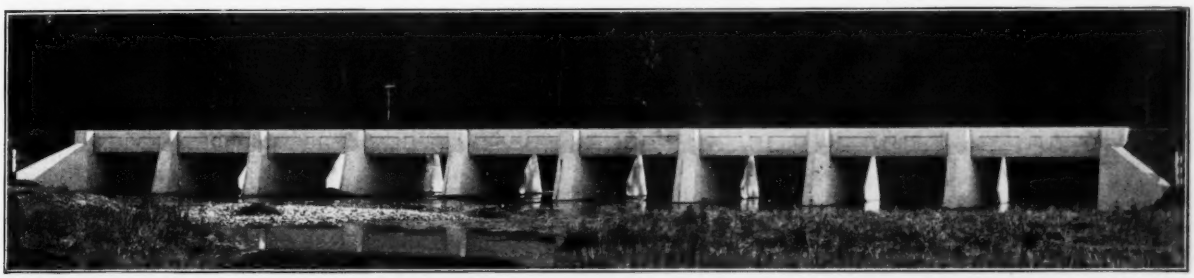
All materials, except timber and concrete, are carried in stock by the stores department, which is provided by the engineering department, with a detailed list of all supplies it is expected to carry. Timber and concrete materials are carried directly by the engineering department at Bradford and East Salamanca, respectively. A supply car is run over the line each month accompanied by the division officers, which distributes the small materials necessary for the following month. All small scrap and obsolete materials are picked up at the same time and forwarded to Du Bois for sorting and reclaiming. An "inquest" is held by the engineering department on all frogs, crossings and special track work sent in, to determine whether they should be scrapped or repaired. All maintenance of way tools are repaired by employees of this department at East Salamanca and Punxatawney. Every three months a detailed inspection of all the materials on hand is made by the general officers. As the supply car goes over the line all tool and pump houses and all station buildings are also inspected.

A system of pensions is in force for the employees of this department in common with those of other departments of the Buffalo, Rochester & Pittsburgh. Under this arrangement employees 70 years of age, with 20 years of continuous service, are entitled to a pension equal to 2 per cent of their average salary for the last ten years, multiplied by the number of years in service. Under these provisions, one roadmaster, one supervisor of bridges and buildings and about 20 foremen and laborers are now carried on the pension roll.

An inspection of the entire road is made by the chief engineer with his staff and the division officers twice each year, traveling by motor cars, and covering about 20 miles of line per day. This inspection is made in great detail, and their problems are discussed with the different foremen along the line.

From the above it can be seen that one of the most important reasons for the high standards of maintenance found on this property is the close supervision given to details and the thorough system of inspection which has been developed. By concentrating attention on a road with limited mileage the officers are able to keep in close touch with the various activities. The detailed and regular system of inspection which has been built up detects the deficiencies and the chief engineer's office then follows them up closely until proper repairs have been made. In this way the men in the field are impressed with the importance of preventing bad conditions and of repairing them promptly when found.

We are indebted to E. F. Robinson, chief engineer, for the opportunity to collect the information contained in the above article.



One of the Concrete Slab Bridges Recently Built.

SLOW ORDERS AND HAND SIGNALS

At a recent staff meeting on the Frisco, inspectors spoke of the necessity of men being very careful when working at a bridge where there is a slow order, not to wave at an engineer on a passing train and not to make any signal with the hands, as the engineer is liable to mistake it for a "high ball" and not reduce speed across the bridge. Cases were cited in the past where the engineer approaching with his train to where men were working waved with his hand at the foreman in charge, who returned the salute by waving his hand; and the engineer thought, or pretended he thought, it was the proceed signal, and did not slacken speed; an accident resulted and the foreman received the blame.

It was decided that if the engineer waves or signals to the foreman and the foreman feels that he must acknowledge the courtesy, the best thing to do is to nod the head; but in any case he should keep the hands down so that nothing can be construed as a signal to continue at regular speed. In case of an accident where slow orders have been disregarded, if the foreman has waved or signaled in any way to the engineer, the engineer can easily lay all blame on the foreman.

Trespassing.—"Are you to be one of the unfortunate 13" is the title of a leaflet which is now being distributed among employees of the St. Louis and San Francisco who come in contact with that portion of the public which uses the railroad tracks as a highway. This leaflet emphasizes the fact that an average of 13 persons are killed every day on the railroads of the United States because they use the railroad tracks as a highway. The trespasser is seldom injured, but is usually killed. It contains the striking statement "they didn't expect to get hurt any more than you," and is signed Your Friend.

A Suggested Program for Track Work

The Importance of Planning Carefully in Advance for the Various Duties To Secure the Proper Results

By W. F. Rench

Supervisor, Pennsylvania Railroad, Perryville, Md.

THE tabular figures shown below are the readings taken in one direction over a sub-division 33 miles long in tests immediately preceding and following the past calendar year. The single direction is given because the speed, which was the same in the two cases, was at the rather high average rate of 58 miles per hour. The resultant was obtained by adding together the spills and vibrations and dividing successively by the distance traversed in miles and the rate of speed used in miles per hour. It is seen that in the later test there was an entire absence of spills and that the resultant was improved more than one-half. This result for a single year's work was unquestionably attained by rigid adherence to a definite program of work.

Test of December 1, 1914	Feature	Test of January 10, 1916
3	Spills	0
1209	Horizontals	397
341	Verticals	211
53	Pedometers	43
35	Time	35
0.84	Resultant	0.34

The importance of system as well as method in track work has been recognized by many roads for a number of years. The engineer maintenance of way of one of the largest trunk lines ascribed the improvement made last year on his road to the particular attention devoted to systematic work. Several recent discussions have emphasized the advantage of standardizing maintenance of way work and of placing the organization upon a permanent basis throughout the year.

The program in use on the sub-division referred to is given below. The various percentages and the detailed items of work were adopted by the supervisor after a careful study of the repairs through several typical years. Care was taken to develop a schedule with alternating periods of intensive repair and entire suspension of renewals. The time between December 1 and September 20 was divided into six periods of seven weeks each, and the dates defining these periods were established as points of peak excellence in maintenance of line and surface. The first three weeks of the long period following September 20 is employed mainly in general policing of the road to attain as finished and attractive an appearance as possible, and such work is regarded as an integral part of the season's repair program.

Throughout the year it is the practice to precede each established date with a three weeks' period of general lining and surfacing. During this period a test is made every ten days with a track instrument and water spiller, in which the spills and vibrations are recorded for each section and the exact times are noted in minutes and seconds. Readings are also taken over certain portions of the sections when thought desirable, and the deficiencies indicated by the record are indicated to the different foremen. A resultant is calculated for each section and from these a rank is given, the complete figures being communicated to all concerned. When there are any special features that operate to handicap the section, a proper notation is made. These tests inspire considerable rivalry, especially as the final standing determines the supervisor's recommendation for the awarding of the several foremen's prizes.

The program of work takes advantage of seasonable distribution of track work fully into account. It provides especially for making such renewals in winter as may be done practically in the closed season, to the end that forces may be kept uniform throughout the year. By extending the more active renewal of ties over six months of the year assurance is obtained that good riding will not be sacrificed to a too rapid progress in repairs. The periodical suspension of tie renewals enables the supervisor to clear the road of accumulated dirt and old ties and to distribute the material required for use in the succeeding period systematically.

It is fully understood that the program is not merely an ideal scheme to be vaguely followed, but a schedule that should be met substantially month by month. As will be noted in the accompanying table, a blank column is provided in which to enter the progress made in the three special items. The percentages of completed work are computed from the material reports and are entered upon the program at the end of each month. The supervisor is able to keep informed constantly of his progress through the daily material reports, or lacking that system, at least through the weekly statements from his foremen of ties, ballast and rail applied in main tracks. Observations are made to detect lack of compliance with the program in policing, tightening of bolts, cleaning of bridge seats, and in the manner of making tie renewals. The suggested program employs but three items for detailed recording, these being such as are of universal application. It might happen that the ditching program planned for the year would be of such definite scope as to form an additional item, and still other items might be added.

A sound condition of the ties is recognized as an essential element in the maintenance of a main running track. Lacking an ample repair in this particular, no track is adequate for the severe operating requirements of today. It thus becomes of the highest consequence to prosecute the renewals steadily and persistently until the required number have been applied. The estimated quantities are obtained by different methods on the several roads. When these are found to be not entirely reliable recourse may be had to an empirical rule. Records have been kept to such good purpose that upon any well-maintained road the requirements for a certain class of track can be approximated by a simple calculation. These records determine the life of the tie in main track, and while it may vary considerably through diverse climatic conditions and unequal traffic burden, and the extensive use of treated ties and of tie plates will cause the figures to increase progressively, it supplies a sufficiently accurate basis for checking the progress of repairs.

The ballast program is in the main coincident with the tie program, for in surfacing the road light lifts are made which consume the ballast chargeable to maintenance expenses, the larger reballasting operations having no part in the repair program. The main advantage in thus regulating the flow of ballast is that the tie renewals are followed closely and the fine line and surface do not deteriorate through insufficient back filling. This sequence also tends toward the preservation of a neat appearance during the period of repairs. A definite

Month	Per cent of ties to be renewed in main tracks at end of month.	Progress.	Per cent of ballasting to be completed at end of month.	Progress	Per cent of rail renewals to be completed at end of month.	Progress	Work To Be Engaged In
January					15		Laying new rail, constructing standard ditches, removing snow and ice, surfacing, shimming and gaging.
February					30		Laying new rail, constructing standard ditches, removing snow and ice.
March					45		Mainly surfacing, continuing rail renewals, starting tie renewals, policing the road, installing under drainage.
April	27		25		50		First half, laying rail, putting in ties, raising track where tie renewals were made; second half, surfacing track.
May	46		35		65		Vigorous prosecution of tie renewals, rail renewals and track raising, with as much policing as possible.
June	57		50		70		First three weeks, surfacing, including track raising; last week, continuing rail and tie renewals. Mow the right of way about the middle of the month.
July	72		68		85		First half, continuing rail and tie renewals; second half, lining and surfacing and gaging.
August	90		78		90		Vigorous prosecution of tie renewals, track raising, rail repairs, with as ample policing as possible.
September	95		90		95		First half, surfacing and lining; second half, general policing of roadway, ballast border and ditches, with rail and tie renewals in sidings. Mow the right of way the second week in this month.
October	100		100		100		Final policing of the road for the division inspection along with necessary lining, surfacing and gaging and repairing crossings.
November							Surfacing and lining in order to enter upon the closed period in the best shape possible.
December							Cleaning snow and ice, keeping ditches open, making standard ditches where possible.

Saturday, to be devoted to policing, cleaning up scrap, pulling grass and weeds.
Between June and September, two days each month to be devoted to tightening bolts.
Last working day each month, bridge seats to be cleaned thoroughly.
When making tie renewals, 3½ days to be devoted to putting in ties, 1½ days to surfacing or raising the stretch renewed.

progress in ballasting is important because when the back filling is deferred until fall the material may not be obtainable and the tracks will thus remain empty through the winter, a condition which strongly contributes to trouble from heaving.

In the item of rail renewal there is a possibility of divergence because the material may not be supplied promptly, but it is believed the program can be substantially complied with under normal conditions. It will be noted that a large percentage of the rail is scheduled to be applied in the winter and early spring. This is rendered practicable by the increasing use of plain base splices and the ability to postpone for a time the spacing of the ties. The program co-ordinates the laying of rail to some extent with the several periods, because such work necessarily requires attention from the section forces, and there might otherwise be interference with the surfacing program.

The advantage of having a definite program for the lesser items of maintenance work is quite tangible. It is vastly easier to regulate the conduct of the sub-division if all the section forces are engaged in substantially the same kind of work. The matter of mowing the right-of-way is important enough to have a specific date set for the two mowings. By having this work completed at one time the full benefit from improved appearance is realized. The indicated plan for policing the road has been found to give excellent results. It is well known that unless a regular time is designated for doing this important work it is liable to be left undone. The tightening of bolts is a similar item which is apt to be neglected unless a set time is regularly employed. The benefit from the attention to this item is noticeable not alone in the increased safety of the joints and the greater freedom from noise, but in the improved riding of the track. Tests have shown that the vibrations are increased over track which contains a large percentage of loose bolts.

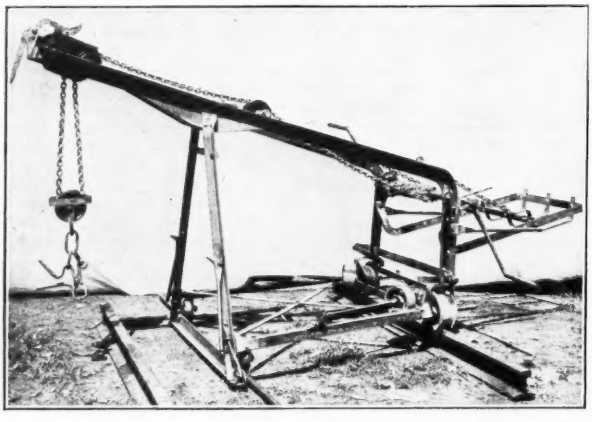
THE MADDEN RAIL LAYER

IN a season such as this when the shortage of track labor is universal, appliances which reduce the number of men required for any important operation are of special interest. For this reason the Madden rail layer, made by the Madden Company, Chicago, is now attracting much attention from railway men because of the records it is making on several roads in the relaying of rail with a limited number of men.

This machine was first developed by P. Madden, roadmaster of the Chicago, Milwaukee & St. Paul at Sparta, Wis., about four years ago, since which time it has been used on over 40 roads. At present several lines, including the Northwestern, the St. Paul and the Great Northern relay practically all of their rail with this machine.

It was described in the Maintenance of Way Section of the *Railway Age Gazette* of September 19, 1913, page 525, but since that time several improvements have been introduced. One is the substitution of a barket arrangement in place of a fixed counterweight to enable the amount of counterweight to be adjusted to the weight of the rail being handled. Another improvement is the addition of a light rail on which the car can be moved forward or backward when laying rail which is not distributed accurately. This rail, which is 20 ft. long and weighs 100 lb., is carried forward with the car when moving from one rail to the next by means of hooks suspended from the frame of the car. When carrying rail inaccurately distributed forward or backward to "heel it in" the small wheels of the car run on this rail.

This car weighs 750 lb. It can be lifted from the track readily to allow trains to pass without the necessity of running to the nearest siding. Five men are required to operate it to best advantage, two at the hoist, one with the rail tongs at the center and one at each end. As one man is required to heel the rail in with any form of organization for comparative purposes, four men are required to place the rail with this machine in contrast with 12 to 20 men with tongs.



THE IMPROVED MADDEN RAIL LAYER.

In addition to this immediate reduction in the number of men required, more rail can be relaid with this machine than with tong men. In a recent instance, 19 men, including 2 flagmen, relaid and fully bolted and spiked 2,700 ft. of track in a day, closing four times to allow trains to pass. On the Louisville & Nashville, 30 men have relaid 2,400 ft. of track per day, including full bolting and spiking. Tests have shown that the machine is capable of laying rail under ordinary conditions as fast as 125 men can throw out the old rail ahead and fully bolt and spike behind it. A gang of 120 men on the Northwestern laid 12,000 ft. of track in this way with one machine in one day last summer. One roadmaster, on the same road, using one of these machines, relaid 32 miles of track last year at an average cost per mile of $297.07, including the unloading of new rail and the loading of the old, the application of tie plates, etc., a material reduction from previous costs.

A particular advantage of this machine during a season such as this is the flexibility of operation which is possible, as five men can place the rail as fast as a large gang can do the other work, while it can also be used with small gangs. The Rock Island has used one of these machines successfully recently with a gang of only 12 men at a point where more labor could not be secured at the time.

COMING CONVENTIONS

PLANS for the convention of the Roadmasters and Maintenance of Way Association, which will be held at the McAlpin Hotel, New York, on September 19 to 22, inclusive, are developing rapidly. The detailed program is as follows:

Tuesday, September 19, 9:30 a. m.—Convention called to order by president. Addresses of welcome, reception to new members, etc.

2:30 p. m.—Papers, reports and discussions.

7:30 p. m.—Reports and discussions.

Wednesday, September 20, 10 a. m.—Reports and discussions. Paper by Geo. Rex, manager treating plants, Atchison, Topeka & Santa Fe.

2 p. m.—Trip over the electrified zone of the Long Island.

7:30 p. m.—Papers, reports and discussions.

Thursday, September 21, 9:30 a. m.—Election of officers, reports and discussions.

2:30 p. m.—Trip over the terminals of the New York Central and the New York, New Haven & Hartford to Stamford, Conn.

8 p. m.—Annual banquet of the Track Supply Association.

Friday, September 22, 10 a. m.—Installation of officers and closing business, adjourning at 11 a. m. to visit the exhibit of the Track Supply Association.

12:30 p. m.—Trip by steamer of the Central Railroad of New Jersey to Atlantic Highlands, then by rail to Asbury Park, returning to Jersey City by rail.

At the opening session on Tuesday morning, Mayor Mitchel of New York City and James A. McCrea, general manager of the Long Island, will welcome the members. At the banquet on Thursday evening, Ralph Peters, president of the Long Island; A. S. Thompkins, judge of the New York Supreme Court, and Fred D. Underwood, president of the Erie, will address the members and guests.

Arrangements are being made for a special train leaving Chicago on Sunday afternoon, September 17, over the New York Central Lines, for the members of the Roadmasters and Supply associations from that city or west.

In addition to the list of 46 firms who have made reservations for space in the exhibit of the Track Supply Association, published last month, the following firms have also applied. The exhibit promises to be one of the largest and most complete ever held:

Bowman, T. B., Chicago, Ill.
Carbic Manufacturing Co., New York City.
Chicago Malleable Castings Co., West Pullman, Ill.
Cleveland Frog & Crossing Co., Cleveland, Ohio.
Dressel Railway Lamp Works, New York City.
Eymon Continuous Crossing Co., Marion, Ohio.
Hatfield Rail Joint Mfg. Co., The, Boston, Mass.
Hussey-Binns Shovel Co., Pittsburgh, Pa.
O. F. Jordan Co., Chicago, Ill.
Seltite Co., Inc., Westchester, N. Y.
Wharton, Jr., & Co., Inc., Philadelphia, Pa.

BRIDGE AND BUILDING CONVENTION

The American Railway Bridge and Building Association will hold its annual convention at the Gruenwald hotel, New Orleans, on October 17 to 19, inclusive. Arrangements are being made for a special train over the Illinois Central from Chicago, leaving on Sunday, October 15, and stopping at the National Cemetery at Vicksburg, Miss., en route. On the Friday following the close of the convention it is expected that a trip will be made by special train to the Pontchartrain trestle on the New Orleans & North Eastern, thence to Slidell, La., where the plant of the American Creosoting Company will be visited. The party will then go over the New Orleans Great Northern to Bogalusa, La., visiting the saw mill of the Great Southern Lumber Company. A trip is also planned by steamer and train over the New Orleans harbor and over the Public Belt Railway to afford the members an opportunity to study the dock construction.

THE two prize-winning papers in the contest on the Handling of Construction Equipment Used in Maintenance of Way Work were published in the Railway Maintenance Engineer for June, page 175. The following contributions received at the same time cover other phases of this problem of interest to railway men concerned with the distribution, operation and maintenance of the various kinds of equipment used for this class of work.

THE MAINTENANCE OF EQUIPMENT

By P. H. Hamilton
St. Louis & San Francisco, Memphis, Tenn.

A number of railroads do not give the maintenance and operation of work equipment the necessary consideration, and as a result much money is wasted in the use of dilapidated or inefficient machines and cars. Instead of repairing equipment after it has been ordered out to a job, it should be overhauled immediately after it has been released from work, thereby getting it into shape for the next work, which may come up on short notice.

When a maintenance of way officer receives authority to do some work he immediately advises his superior as to the special equipment he will need. The road is canvassed, the best of the available equipment is sent and reaches him in the same condition as when released from the previous job. The steam shovel has worn-out chains, the gear wheels need traming, the throttles and water tank leak, etc. The Lidgerwood shows up apparently in first-class shape; but the cable is shorter than desired. The center plow is apparently in good shape. The dirt cars arrive in good running condition, but otherwise in bad shape. The side dumping equipment is out of order, and the sides are held shut by stakes.

When the first train of dirt is loaded and hauled out it is found that the plow runs to one side, and the sides are torn from some of the cars. Every possible means of adjustment is tried to make it drag on center, but without success. On account of the heavy load, the pressure against one side of the cars is too great, and it is necessary to cut down the loads. Measurement finally shows that the plow is constructed off center; that is, one side of the nose is considerably longer. This makes no difference when the cars are loaded light, but it prevents heavy loading. The air pump on the locomotive is bad, the train line is leaking, and it is necessary to stand on the main line an extra length of time pumping up the air to operate the spreader.

When work equipment is released from a job those in charge should be required to make statements covering the condition of each machine or car, giving recommendations as to improvements. These reports should be sent to some designated officer, who will give them consideration and, being an expert, he will act on the suggestions as he sees fit. The reports should be made a part of the equipment record. Most roads arrange for reports from division officers, showing the location and condition of special work equipment on the division. The entries in these reports, under the heading "Condition," generally specify "Good," "Fair," or "Bad." "Fair" or "Good" give little information, and when some equipment is needed a man must be sent to the station where it is stored to get the necessary information, but he will not catch the minor defects which will show up in operation.

A shortage of equipment is expensive, and on large jobs auxiliary equipment should be provided. It is often expedient to rent or lease machines from other roads, or from jobbers or manufacturers for auxiliary use, instead of investing money in additional plant. If a steam shovel is placed in first-class shape it should go through a season safely. However, on emergency work an auxiliary shovel may be justified as insurance against delay in the work. Extra cars should be on hand, as cars are continually in need of repairs. Two 50-ton jacks should be available for use in wrecking. Two or more channel irons often come in handy in pulling trucks out of holes. Clamps, swivels, melting furnaces, babbitt metal for splicing cables, etc., should be available. A good blacksmith and one or more car repairers will help keep the cars in service and on a job of any magnitude there is always plenty of work for blacksmiths and carpenters.

No matter how thorough the preparation, and how efficient the organization, there are many opportunities for the exercise of ingenuity and initiative in keeping the work in progress. Situations arise which must be met promptly.

During cold weather machines should not be put under load until thoroughly warmed up. In winter it is best to keep the plow on an empty car to prevent it from freezing fast over night. In selecting cars for handling earth or ballast, for handling rail or bridge material, or for handling ties, those which can be loaded to fullest capacity should be taken.

The dump cars commonly used by contractors are best for handling dirt, but they are not always available. More or less delay is often experienced, trying to dislodge sticky earth from them. It is sometimes economical to cover the floors of the cars with sheet zinc. Earth will not stick to this, and any metal will clean itself more readily than wood. Steel frame, convertible cars with flat bottoms and swinging sides are best for use with center and side plows. These steel frame cars are built for handling heavy loads, and plows can be run over them with little damage to them. When using a spreader it should be located at the rear of the train; that is, farthest from the engine. While the cars are being opened up the wings should be lowered and made ready for

work. As the train moves ahead it spreads the dirt being unloaded. Where equipment is operated by air, the train line should be kept in first-class shape. Sometimes it is expedient to have an auxiliary water tank with a work engine to prevent the loss of time running for water.

HANDLING CONSTRUCTION EQUIPMENT

By O. W. Duffy

Superintendent of Construction Equipment, Chicago, Burlington & Quincy, Galesburg, Ill.

A great many railroads at the close of the construction season sidetrack all construction equipment, and give it no attention other than to make repairs, until the spring work opens up. The result is that the money invested does not produce any returns during the winter.

On a well-organized railroad all construction equipment should be in the care of one man, who should work in close touch with the general manager, the engineer maintenance of way and the general superintendents. Before the work is started in the spring it should be gone over and a decision should be reached as to the equipment necessary to handle this work to the best advantage. When a superintendent is ready to commence his work he should advise the man in charge of construction equipment to furnish the necessary outfit on a given date and it should be the duty of the latter to have the machinery, cars and other equipment on the job with competent men to operate them, ready to commence the work on the date set. Every man in that organization should know his place and be there to carry out his part. In this way all delays in starting the work and perfecting the organization are eliminated. The man in charge of the equipment must understand the handling of all the different machines used, and should be held responsible for the work they do.

The construction equipment department should receive a telegraphic report every day from each outfit, showing just what work has been performed and the extent and nature of the delays. A weekly report should also be made by the steam shovel and ditcher engineers, giving a list of all the machines in service and their condition. By doing this, the equipment superintendent keeps in close touch with his men and the machinery, and any defects that show up can be corrected before the machines are put out of commission.

As soon as a steam shovel or ditcher finishes any work, the division superintendent notifies the equipment superintendent, who, being in close touch with the general manager and chief engineer, can arrange to move the outfit to some other work. Unless properly controlled, many divisions will hold more equipment than is needed, while other divisions are short of it.

A stock of repairs should be carried at some central location and when any material or supplies are needed for the outfits, they can be furnished quickly. All requisitions for construction equipment and supplies should go through the equipment department office, as many of the requirements of construction work can be filled with supplies released from some other place, instead of buying new material.

After the season's work is completed, there is considerable work done by hand that should be done with the construction machinery. For instance, by using two small drums in place of one large one, a steam shovel will handle a 1½-cu. yd. clam-shell bucket, and do the work of a locomotive crane, storing coal, loading coal from stock piles, handling cinders at pits, coaling engines where emergency coaling stations are found necessary in cold weather, cleaning up cinders and doing miscellaneous work which is ordinarily done by hand at a much higher cost. The disinfection of stock cars can be accomplished with economy by placing an air pump on a steam shovel and coupling up the injector to a steam hose to furnish hot water.

When ice is being loaded and unloaded at an ice house the cars can be spotted by equipping a steam shovel with 1,000 ft. of ¾-in. cable and cutting it out near the ice house, so that the machine can pull the cars. Where there is light ditching to do a wing of the desired shape on a Jordan spreader can do a lot of work quickly at small expense, that is now done by hand or teams.

In conclusion, the equipment department should make a weekly report to the general manager and engineer maintenance of way, showing all the equipment, its condition, where located and whether or not in service. This report can be kept up to date only with the co-operation of the superintendents in keeping the equipment department advised as to when and where any of the outfits are moved. The head of this department should work under the superintendent of motive power and be carried on his roll, as much of his work in keeping the equipment in good condition will come under the jurisdiction of the mechanical department.

METHODS OF GRAVEL PIT OPERATION

By L. M. Gunstead

Supervisor, Illinois Central, Waterloo, Iowa.

The first thing that is necessary after a gravel pit has been located is to start a gang of about 20 teams removing the top soil that is not fit for ballast, but which can be loaded on cars by the shovel and used for widening banks and filling openings.

A gang of about 30 men should then be started laying temporary pit tracks, one storage track for loads and one for empty gravel cars, each 1,500 ft. long and connected with tracks leading to the main line. A track 200 ft. long, where cars can be placed for light repairs, is also required. It will be necessary to have another track of the same length for engines, this track to be provided with a temporary cinder pit. In some locations water can be provided by digging a hole 10 to 12 ft. deep, thus enabling engines to syphon water. This, of course, is intended for locations where regular water stations are not near enough and serious delay to the pit work would result from running to the nearest water station.

The next thing is to arrange work trains and equipment to handle the output. This is governed by the length of the haul. For instance, if it is necessary to haul the gravel from 20 to 75 miles or more, three work trains will be required, consisting of 25 or 30 Haskell & Barker side dump gravel cars or the number that engines can handle over the division. A Lidgerwood unloader with a gravel plow and cable is also required. The movement of these work trains can be so arranged that the one Lidgerwood and plow can unload for all three trains by arranging to have the last train using them turn them over to the next train of loads at the meeting point when returning with empties. It will require one engine at the pit to spot cars for the shovel and switch them out to the load storage track.

It will take two men, in addition to the regular engineman, craneman and fireman, on the shovel, to lay track for the shovel and cave down steep gravel banks when necessary. An experienced man will be required to run the Lidgerwood.

The output from one steam shovel will require three track surfacing gangs of 30 men each. They should be located at three different points on the work, as the three gangs so located can accomplish more than is possible

where the same number of men are used in one gang. Local section gangs can be used for throwing pit tracks when necessary.

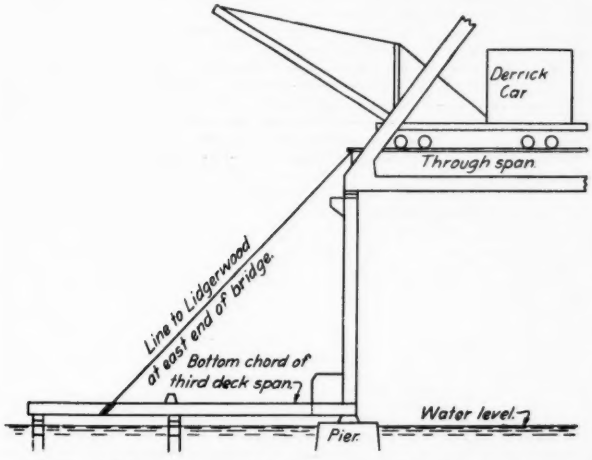
One car repair man should be furnished to inspect, oil and make necessary light repairs on the cars at the pit. It should be the duty of the gravel pit foreman to keep the time of the men employed at the pit, check the number of cars loaded and direct the conductors of work trains where to unload gravel. He in turn should receive his instructions from his supervisor or road master.

The equipment for a steam shovel ditching outfit should consist of a work train and crew, a mud plow, a bank leveler and 10 flat cars, full staked. It will require one foreman and 6 laborers to slope the bank and handle the bank leveler. As only 2 men are required to handle the leveler, the remaining 4 men and the foreman can remain at the ditch while the train is unloading. An experienced conductor should be assigned to this work, as most of it is handled on the main line, and much time can be saved by handling the trains properly.

Quick Work Prevents Flood Damage

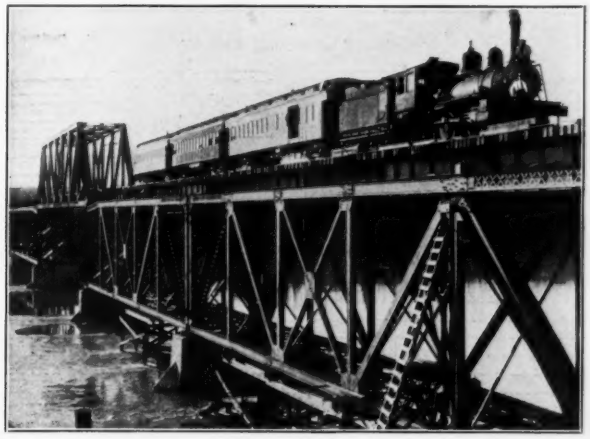
THE erection of the Athabasca river bridge of the Edmonton, Dunvegan & British Columbia about 100 miles north of Edmonton, Alberta, was interrupted by an unlooked-for and serious rise of the river, which caused an accumulation of drift wood that threatened to carry away one of the spans. The bridge was saved by a quick decision of the erection foreman to use a rather unusual means to solve the difficulty.

The bridge is a symmetrical structure built for a single track. It has a 175-ft. through truss span in the middle with two 150-ft. deck truss spans and one 70-ft. deck plate girder span on either side. The total weight of the steel erected is 1,127 tons. All five trusses are of the riveted type and were erected on falsework in the ordinary manner with a double boom derrick car, working from the east end of the bridge. The through span is supported on structural steel posts, riveted to and forming a part of the adjoining deck truss spans. The lower end of each of these posts was field-connected to the gusset plates above the bearings, these gussets being shop riveted to the bottom chords of the flanking spans. This was the layout adopted by the consulting designing engineer of the railway and necessitated the erection of the first length of bottom chord of the third deck span from falsework under the through span before the vertical posts supporting the latter could be placed.

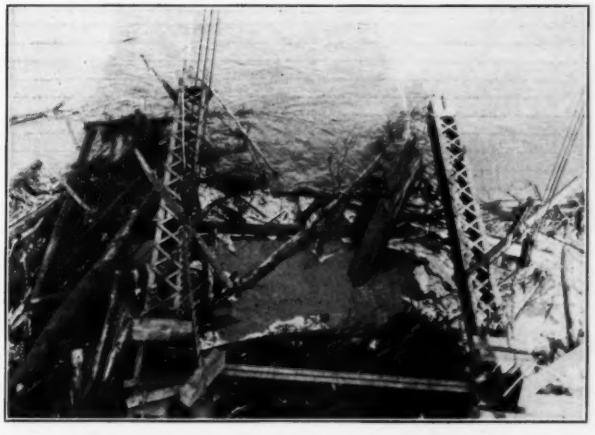


THE MANNER OF MAKING THE CONNECTION.

Almost immediately after the completion of the channel span and the removal of the falsework upon which it had been erected, the river rose very rapidly and the tops of the piers were soon under water, while the bottom chords of the deck spans were clear of the water surface by only a very few inches. The flood water carried a large amount of drift wood, much of which became lodged around the pier supporting the west end of the through span. The conditions were aggravated by the presence so close to the water of the end sections of the bottom chords of the third deck span. In a short time the accumulation of timber at this point, some of the pieces being logs of very large dimensions, was offering such resistance to the flow of the water that the steel bent was being pushed down stream at the rate of one-half inch a minute.



THE COMPLETED BRIDGE.



DEBRIS LODGED IN THE BRIDGE.

The quick decision of the erection foreman undoubtedly saved the span, coupled with the fortunate presence of a Lidgerwood unloader near the bridge. Leav-

ing the Lidgerwood on the east bank of the river, a line was run out over the bridge and hitches were taken on the outer ends of the two projecting sections of the bottom chords of the third span. The derrick car was placed in position on the outer end of the through span to load the pier members and provide as much frictional resistance as possible against any tendency of the vertical posts to kick under. The Lidgerwood then hauled in its line, thereby deliberately bending up the two bottom chord members a sufficient amount to release the jamming logs. After the level of the river had fallen, the chords were straightened again and the points where the bends had been introduced were well reinforced. The erection then proceeded in the normal manner.

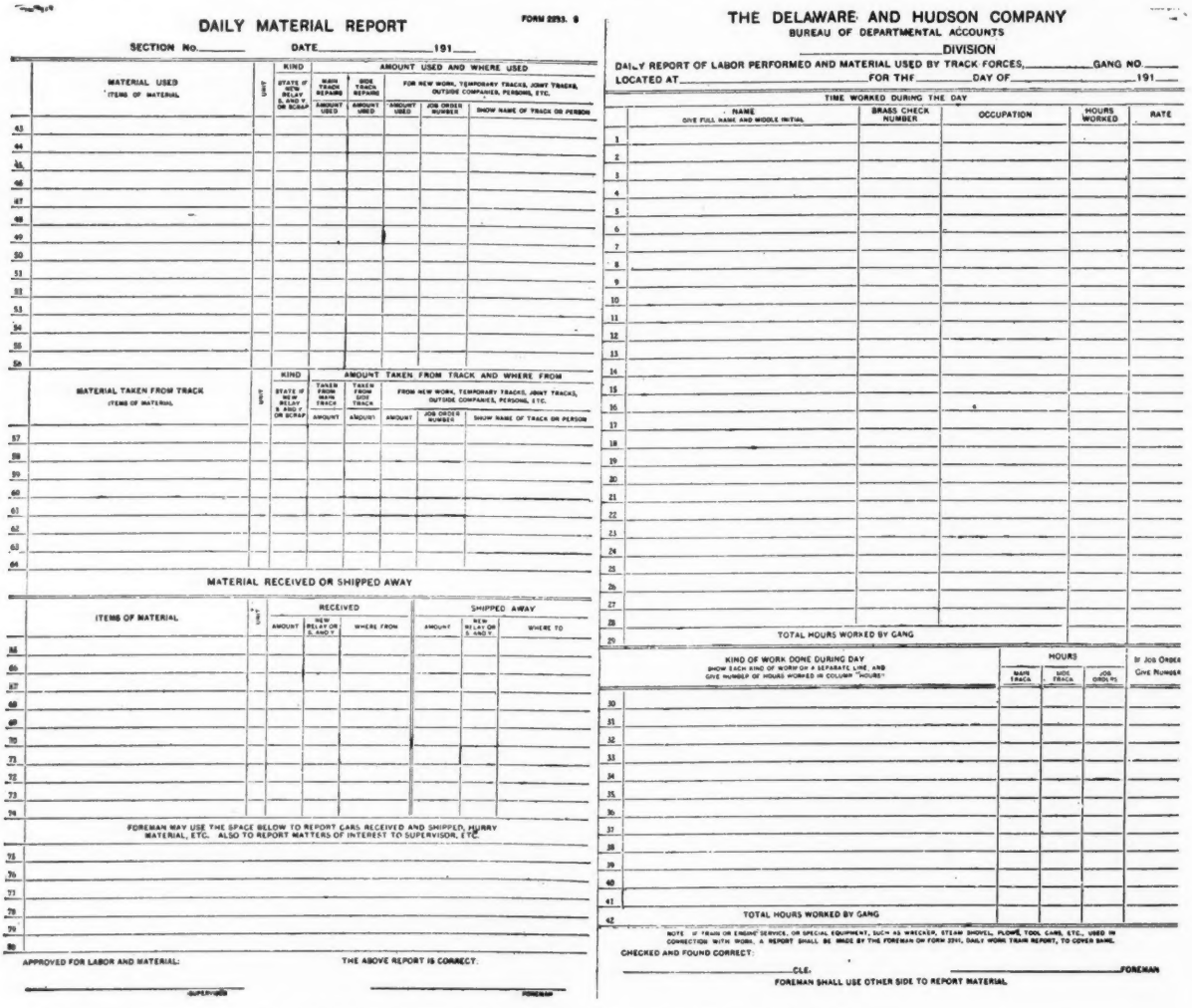
We are indebted for the above information to P. L. Pratley, designing engineer of the Dominion Bridge Company, Montreal, which company fabricated and erected this bridge.

Simplifying Section Foremen's Reports

BY KENNETH L. VAN AUKEN

MANY foremen have little education along clerical lines, and are not able to make up an elaborate monthly time book accurately. It is difficult for them to balance the time and distribution of labor with the total hours worked. Furthermore, when they wait until the end of the month to enter up the time and distribution, many errors are likely to occur. In like manner it is difficult for most track foremen to make out complicated monthly material statements, with the result that the roadmaster or his clerk usually has to put in considerable time correcting them.

The Delaware and Hudson recently investigated this subject and decided that a daily report on time, distribution, material and tools would solve most of these difficulties. With the monthly system the records showing the time of the laborers and the distribution of the work, the material used, recovered, received or shipped, and the report of the tools on hand must all be made at the end of the month, necessitating much overtime work on the part of the foreman. With the daily reports adopted by this road, the entire report on time, distribution, tools and materials is made at the close of the day.



DAILY MATERIAL REPORT — FORM 2253. 8

SECTION No._____ DATE_____191__

	MATERIAL USED ITEMS OF MATERIAL	UNIT	KIND: STATE IF NEW RELAY S. AND T. OR SCRAP	AMOUNT USED AND WHERE USED: MAIN TRACK REPAIRS AMOUNT USED	SIDE TRACK REPAIRS AMOUNT USED	FOR NEW WORK, TEMPORARY TRACKS, JOINT TRACKS, OUTSIDE COMPANIES, PERSONS, ETC.: AMOUNT USED	JOB ORDER NUMBER	SHOW NAME OF TRACK OR PERSON
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								
54								
55								
56								

	MATERIAL TAKEN FROM TRACK ITEMS OF MATERIAL	UNIT	KIND: STATE IF NEW RELAY S. AND T. OR SCRAP	AMOUNT TAKEN FROM TRACK AND WHERE FROM: TAKEN FROM MAIN TRACK AMOUNT	TAKEN FROM SIDE TRACK AMOUNT	FROM NEW WORK, TEMPORARY TRACKS, JOINT TRACKS, OUTSIDE COMPANIES, PERSONS, ETC.: AMOUNT	JOB ORDER NUMBER	SHOW NAME OF TRACK OR PERSON
57								
58								
59								
60								
61								
62								
63								
64								

MATERIAL RECEIVED OR SHIPPED AWAY

	ITEMS OF MATERIAL	UNIT	RECEIVED: AMOUNT	NEW RELAY OR S. AND T.	WHERE FROM	SHIPPED AWAY: AMOUNT	NEW RELAY OR S. AND T.	WHERE TO
65								
66								
67								
68								
69								
70								
71								
72								
73								
74								

FOREMAN MAY USE THE SPACE BELOW TO REPORT CARS RECEIVED AND SHIPPED, HURRY MATERIAL, ETC. ALSO TO REPORT MATTERS OF INTEREST TO SUPERVISOR, ETC.

75 76 77 78 79 80

APPROVED FOR LABOR AND MATERIAL: _____ SUPERVISOR

THE ABOVE REPORT IS CORRECT: _____ FOREMAN

THE DELAWARE AND HUDSON COMPANY
BUREAU OF DEPARTMENTAL ACCOUNTS

_____DIVISION

DAILY REPORT OF LABOR PERFORMED AND MATERIAL USED BY TRACK FORCES,_____GANG NO.____
LOCATED AT_____FOR THE_____DAY OF_____191__

TIME WORKED DURING THE DAY

	NAME GIVE FULL NAME AND MIDDLE INITIAL	BRASS CHECK NUMBER	OCCUPATION	HOURS WORKED	RATE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29	TOTAL HOURS WORKED BY GANG				

	KIND OF WORK DONE DURING DAY SHOW EACH KIND OF WORK ON A SEPARATE LINE, AND GIVE NUMBER OF HOURS WORKED IN COLUMN "HOURS"	HOURS: MAIN TRACK	SIDE TRACK	JOB ORDERS	Or JOB ORDER GIVE NUMBER
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42	TOTAL HOURS WORKED BY GANG				

NOTE — IF TRAIN OR ENGINE SERVICE, OR SPECIAL EQUIPMENT, SUCH AS WRECKER, STEAM SHOVEL, PLOW, TOOL CARS, ETC., USED IN CONNECTION WITH WORK, A REPORT SHALL BE MADE BY THE FOREMAN ON FORM 2241, DAILY WORK TRAIN REPORT, TO COVER SAME.

CHECKED AND FOUND CORRECT:

_____CLK. _____FOREMAN

FOREMAN SHALL USE OTHER SIDE TO REPORT MATERIAL

BOTH SIDES OF THE DELAWARE & HUDSON DAILY TIME SHEET.

The advantages cited are that the facts are fresh in the trackman's memory, and he is then able to relieve his mind of further responsibility; the possibility of padding the payroll is reduced; accurate reports covering the character of the work performed are secured; more accurate reports are obtained of material used and it is easier to credit the cost of a given job with the value of second-hand or scrap material; the delivery of material is established within 24 hours; the roadmasters are in possession of all facts covering the performance of section gangs within 24 hours; they are better able to control the immediate force allotment; the possibility of performing work for outside concerns, without compensation, is reduced since section foremen, when reporting monthly, quite frequently overlook this feature; a comparison of labor items with a report of material used for the same day is available, and the daily report gives an accurate determination of unit costs for renewals.

The form which has been developed by the Delaware and Hudson makes it possible to get on a single sheet all the desired information regarding the time and its distribution and material. On one side, the names of the laborers are entered. The check numbers are shown in the second column, hours worked in the next to the last, and the rate of pay in the last column. At the lower part of the sheet the foreman enters the different kinds of work done, together with the hours worked by the gang on each kind of work. The hours are further separated under main-track, side-track and job-order headings. On the opposite side of the blank are given spaces for entering the material used and taken from the track, the material received or shipped away, and below, a space in which the foreman may report cars received and shipped, request material to be rushed, or mention any other matters of interest to the roadmaster.

This makes it unnecessary for the foreman to handle more than one kind of report, and its simplicity makes his work much easier. He writes in the kind of work done during the day, and in a similar manner writes in the materials used, taken from track, received or shipped. It is not necessary to have a large number of lines in order to include every item of material or distribution that is encountered in a single day's work. Compared with some of the voluminous books and reports required on some roads, these reports have been simplified enormously.

A LARGE ROADSIDE TANK

By C. R. KNOWLES

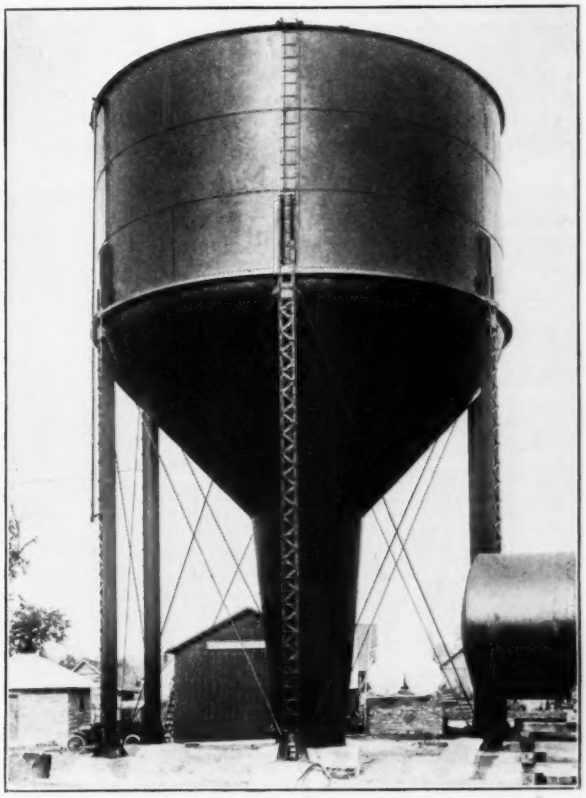
General Superintendent of Water Service, Illinois Central, Chicago, Ill.

THE 200,000-gal. steel tank recently constructed by the Illinois Central to supply water to road locomotives at Obion, Tenn., marks an important step in railway water tank construction, as it is the largest roadside railway water tank ever constructed for locomotive supply. The tank is a standard conical bottom steel railway water tank with settling drum. The tank proper is 36 ft. in diameter by 18 ft. high and is constructed of ⅜-in. and 5/16-in. plates. The bottom forms a cone connecting the shell of the tank proper to the mud drum and is 36 ft. in diameter at the top and 10 ft. at the bottom. The total depth of this bottom from the shell to the mud drum is 15 ft. The plates forming the shell are 7/16-in. thick.

The mud drum is 20 ft. high, 10 ft. in diameter at the top and 6 ft. at the bottom. The capacity of the tank is figured from the top of the mud drum, leaving ample space for the precipitation of suspended matter. The mud drum is equipped with a 6-in. washout valve for cleaning the tank while in service. The roof is conical with a pitch of 4⅜ in 12, constructed of ⅛-in. plates secured to the top of tank by means of angles riveted to both tank and roof. A 12-in. cast iron finial surmounts the apex of the roof.

The height of tank over all above foundations is 60 ft. The tower consists of six posts, each constructed of two 12-in. 25-lb. channels with a 14½-in. cover plate and lacing bars 2 in. by ⅜ in., 14⅝ in. center to center. The foundation contains 122 cu. yd. of concrete and consists of six outside piers, 10 ft. 6 in. square at the bottom and 3 ft. 4 in. at the top, and one central pier 11 ft. square at the bottom, the total bearing on the soil being 131.25 sq. ft.

The total weight of tank and tower is 117,000 lb., distributed as follows: Tank 78,000 lb., mud drum 9,000 lb., tower 30,000 lb. The weight of the water alone when the tank is full is 1,749,300 lb., making a total weight on foundation of 1,771,000 lb. The tank was constructed by the Chicago Bridge and Iron Works and cost complete, including foundation, $6,786.40.



THE 200,000-GAL. TANK AT OBION, TENN.

The pumping equipment supplying water to the tank is installed in duplicate units, consisting of centrifugal pumps driven by oil engines, each pumping unit having a capacity of 500 gal. per min. The maximum daily pumping capacity is 700,000 gal. This quantity of water may be pumped at a cost of less than ½ cent per 1,000 gal. Water is delivered to locomotives through 1,200 ft. of 14-in. cast iron pipe and two 12-in. penstocks serving the north and south bound tracks.

This tank and water station were constructed to take the place of water stations formerly located at Rives and Newbern and forms a part of the scheme of rearrangement of water stations between Fulton and Memphis

made necessary on account of double track construction. The distance to Fulton, the first water station north of Obion is 24.87 miles and to Dyersburg the first station south 20.09 miles. With the completion of the new water station at Curve 37.30 miles south of Obion, it will be possible for through freights to run by Dyersburg, taking water at Curve and Obion. By constructing a tank of this capacity it was possible to dispense with the services of a night pumper and handle the work with one man. This saving is in excess of the additional cost for the tank and also guards against possibility of failure of the supply owing to breakdowns.

A NEW USE FOR A TRACK JACK

THE accompanying photograph illustrates a new use for a track jack. By the help of two attachments known respectively as a "universal tie spacer" and a "jack attachment," sold by the Reading Specialties Company, Reading, Pa., the track jack is made to act in a horizontal position to space ties. The tie spacer is an iron yoke made to fit over the head of the rail with an arm on one side to take the thrust of the jack. The jack attachment is a small casting made to fit over the head of

THE TRACK JACK AND TIE SPACER.

the jack and provided with a saddle to bear against the yoke. With the foot of the jack against the side of a tie and the yoke in position over the top of the rail, the "raising" of the jack causes the yoke to grip the rail and it is thus possible to exert a high pressure against the side of the tie.

The yoke can be used alone in conjunction with a lining bar to accomplish the same purpose in a somewhat less effective manner in gravel or cinder ballast. When used with the jack and jack attachment, it is possible to space ties easily in heavy stone or slag ballast. It is not necessary to crib out in front of the ties except in the case of the first tie to be moved. With all subsequent ties the cribs can be pushed ahead of them. It is not necessary to detach the jack attachment from the tie spacer, nor the jack from the jack attachment when moving the device from one tie to the next. As the yoke fits loosely over the rail it can be removed quickly as soon as the jack is released. The removal of the jack can be accomplished in much less time than is possible in the case of a jack in position under a rail.

The yokes are made in three different sizes. Size 1 fits all weights of rails from 55 to 80-lb., inclusive. Size 2 is for rails from 85 to 100-lb., inclusive, except the 100-lb. P. R. R. section, and size 3 fits all the larger sizes of rails. Owing to the simplicity of this device and the ease with which the men can be taught to use it, it is said to result in very material economy in the work of spacing ties. It has received extended use on the Baltimore & Ohio and other roads.

CUTTING BRUSH AND WEEDS

BY E. F. PETRY,
Track Foreman, Baltimore & Ohio Southwestern, St. Bernard, O.

ALL grass and weeds growing in the ballast should be cut at least once a year, and in some parts of the country more than once. Some railroads prefer to keep the track free of grass and weeds at all times and others allow them to grow until fall on account of the dust in the summer months. The practice to be followed depends largely upon the climate, the kind of ballast used and the financial condition of the road. However, all weeds should be cut before the plants go to seed. The weeds and brush on the right-of-way also should be cut at least once a year, the weeds before going to seed, and the brush when the sap rises the second time.

The right time to cut brush is in August when the sap is rising the second time. If brush is cut at this period much of it will be destroyed, as it will lose much of its sap and there will not be sufficient growing weather remaining for it to recuperate, causing much of it to die before the next spring. If it is cut later in the season much of the sap will be in the roots, ready to shoot up from the old stumps the next spring, while if cut earlier, even if much of its strength is lost, there will still be enough good growing weather for it to recover fully before autumn.

Shovels are generally used to cut the grass and weeds in the ballast, and they make good weed cutters, although in fine gravel, sand, cinder and dirt ballast a weed cutter with a long handle, or a hoe is used to some extent, and where the grass and weeds are not too hard and tough or the ballast too coarse much more work can be done than with a shovel, and it is not so tiresome. Whether a shovel, weed cutter or hoe is used, it should be kept sharp. A flat file is a very good thing to use for that purpose. Some trackmen do not favor the idea of sharpening tools, as they will get dull again, but if one will watch the results obtained by using a dull, as compared with a sharp shovel, he will soon be convinced that sharpening tools is a time-saving proposition. A tool will not last as long when kept sharp, but the greater amount of work done will offset many times the wear of it. If a man does only 10 per cent more work with a sharp shovel than with a dull one, this will pay for a new shovel in less than 3 days.

The most common practice when cutting grass and weeds out of the ballast is to let each man throw out by hand the grass he has cut. This is slow work. A better way to do is to have the men cut the grass and weeds and one man follow with a garden rake, raking out all the larger weeds without picking up every little blade of grass. By this method a gang of men will cut from 25 to 50 per cent more grass and weeds in a day. On some roads picks are used to loosen the grass and weeds, which are then pulled and thrown out by hand. This is slow work and should only be done in stone ballast.

On some roads it is the practice to send one or two men to cut the brush or do the right-of-way mowing to avoid furnishing tools for all the men. This is a poor way to economize, as the men away from the foreman are liable to make such work last as long as possible. As a result the greater amount of labor required will generally reach several times the price of the extra tools.

Track Put Up On Crushed Gravel

Crushed Gravel Ballast on the Rock Island

THE availability for use as ballast of a deposit of gravel depends principally upon the relative proportions of the various sizes of particles and the content of clay or loam. If the amount of fine sand or foreign matter is high the gravel will give a dusty ballast and one that drains improperly. If, on the other hand, the gravel contains a considerable amount of particles or boulders which will not pass through a 2 or 3-in. screen, it will be troublesome and expensive to handle in the track. The first objection can be overcome by washing the gravel and this has been done in certain pits during the past eight years or more. The other difficulty can be overcome by passing the gravel through a rock crusher and this is now being done, in combination with washing, in a pit serving the Chicago, Rock Island & Pacific at Rockdale, near Joliet, Ill. The success of either of these remedies depends, of course, upon the economy with which they can be carried out, as affected by the physical condition or situation of the pit.

Except for the fact that a considerable portion of the stone is too large for use in track, the gravel at Rockdale would be an excellent natural ballast; at the same time the pit presents physical characteristics which are most favorable for economical operation. The face of the pit is 1¾ miles long and 65 ft. high above a general ground level, which can readily be drained, while there is a considerable deposit of material below this level which affords possibilities of future development by dredging. The content of clay or loam is small and the stripping is so thin that with the use of the washing process no attempt is made to strip. The sand contains only a small amount of the extremely fine particles. The pit is owned and operated by the Chicago Gravel Company and the output is used commercially as well as for railroad ballast.

The gravel is excavated with a 175-B Bucyrus turntable steam shovel with a 65-ft. boom and a 3½-cu. yd. dipper. This machine has a capacity of 3,500 cu. yd. in nine hours. The gravel is hauled to the crushers over standard gage tracks in two trains consisting of two Roger ballast cars of 40 cu. yd. capacity each, handled by 40-ton, 4-wheel switch engines. The crushing plant consists of four No. 6 Allis-Chalmers gyratory crushers with a capacity of 300 cu. yd. per hour. Two Symons Brothers disc crushers are provided to recrush all stone which fails to pass through the largest size screen. A grizzly is provided under the hopper over the four primary crushers in order to by-pass as much as possible of the fine material to avoid the possibility of choking up the crushers. The rock is transmitted from the track hopper to the crushers and from the crushers to screens, etc., on heavy conveyor belts.

The screening and washing plant consists of seven steel tanks 19 ft. in diameter and of varying heights, to a maximum of 48 ft. and seven rows of four screens each arranged in two banks by which the material is separated into six different sizes. In one bank the sizes of the mesh in the screens are in order, 2 in., 1¼ in., ⅜ in. and ¼ in., and they separate the stone respectively into what are known as 2-in. stone, 1-in. stone, roofing gravel and torpedo sand. In the other bank the sizes are 2½ in., 1½ in. and ¼ in.

The process of screening is the direct opposite of the usual method in that the material passes over the largest size screen first, all the material retained on the screen being passed directly to a bin while that which passes through the screen is carried to the next smaller screen. Fifteen hundred gallons of water per minute is used for washing, a stream of water being played on each screen. The separation of the clay and loam takes place in a box under the last screen, where a tilting device periodically pours off the water containing the suspended matter and permits the sand to drop into a bin.

Bins are provided for each of the sizes enumerated above and in addition there is one bin for ballast which consists of the run of the pit for the material retained on the 1¼-in., ⅜-in. and ¼-in. screens plus 10 per cent of the torpedo sand. The run of the pit for the three larger sizes consists approximately of one-fourth roofing gravel, one-fourth 1-in. stone and one-half 2-in. stone. Ten per cent of torpedo sand is added because it has been found

that this amount of sand facilitates the handling of the ballast in track.

Gravel from this pit was first used on the Rock Island for ballast in 1912, the gravel being crushed to a 2-in. size without washing. This gave a fairly satisfactory ballast, but some tendency toward churning of track was noted and it was finally concluded that it was not entirely suitable for the standard of track desired for the main lines of the Rock Island. As a result, the washing feature was added in 1913 and has been carried on for the three last seasons, according to the arrangement described above. The ballast has been used on the main line of the Illinois division between Chicago and Rock Island, and on the main line of the Missouri division between Rock Island and Eldon, Iowa. During the past season the average daily output has been about 65 cars, about 35 cars of which has been used for concrete on track elevation in Chicago, and ordinary commercial purposes. The rest is being used as ballast in a general improvement of the tracks over the district mentioned above, including a raise out of face and extensive tie and rail renewals.

A special effort is made not to mix the new ballast with the old. In general no new ballast is delivered until all the old ballast has been removed to the level of the bottom of the ties, either by raising the tracks or by using it to widen the shoulders. Ordinarily the ballast was unloaded in two portions: first, a sufficient amount for making the lift with skeleton track, and later the amount necessary for dressing to the standard ballast section. The track was raised by shovel tamping and then left for a period of about two weeks, when it was gone over again and all low spots were raised with the use of tamping picks.

This crushed and washed gravel costs approximately two-thirds the average cost of crushed stone ballast available in the same general territory, and with the experience had thus far the results obtained have been entirely satisfactory. It is much easier to handle in track than rock ballast. In fact, it can be worked almost exactly the same as gravel, shovels being used for most of the tamping as mentioned above. Owing to the fact that a considerable portion of the stone has passed through a crusher, a large portion of the particles are angular in shape rather than round, a fact which adds materially to the holding power of the material as a ballast and there is not the tendency to roll which has sometimes been experienced with washed gravel which has not been crushed. The ballast looks very much like rock ballast in track and is equally clean and free from dust.

Reducing Track Tool Expenses

BY M. E. CARROLL

IF a newly-appointed roadmaster, making his first trip over his division, found three section men sitting in the shade of a tree smoking their pipes, and upon his return trip the next day found them still sitting there, without question he would start a vigorous inquiry into the cause of this condition. If from this inquiry he learned that this practice was regularly authorized and that he must carry the expense of these three men for the entire season, he would certainly consider that he was being imposed upon, and doubtless would spend some time and energy in planning a means of eliminating this unusual charge. Yet a roadmaster on an average main line division is incurring an equivalent expense through the increase in the cost of his track tools without being nearly as much disturbed over it.

The gigantic war being waged in Europe has had a powerful and far-reaching influence over American manufactures. One of the results of the interruption of our imports was a shortage of tungsten used in the manufacture of high-speed steel. In a few months the price of this commodity advanced several hundred per cent, causing such an increase in the price of high-speed drill bits as to render their use almost prohibitive.

Partly in sympathy with the high-speed steel situation and partly because of the demand for export purposes, the price of crucible steel, of which many of the best-grade track tools are made, has also experienced a sharp rise. This, together with the scarcity of labor in all manufacturing lines, has resulted in a general increase in the cost of all tools used in track maintenance, amounting to nearly 20 per cent.

In recent years the flat drill bit of high-speed steel has come into general use for rail-drilling. The cost of these drill bits has risen from $0.70 to $3.10 each in a little more than a year, and on many lines the use of carbon steel drill bits has been resumed. Unfortunately, it has not been the practice to call the attention of the trackmen to this change in the quality of the steel, and they discover the difference by trying to make the carbon steel drill bit do the same work which they have been doing with the high-speed drill bit. The result is a broken bit and a waste of labor and material. Unless complete instructions are given trackmen in the use of drilling machines and the handling of bits much time will be lost in drilling rails and many bits damaged.

There are two features in connection with the drill-bit situation which will bear close attention on any railroad. It is of the utmost importance to watch the disposition of the old high-speed drill bits when discarded by trackmen. These scrap bits are worth more than the new ones cost two years ago. Each one should be carefully saved, sent to the roadmaster's office by registered package, and turned over to an expert tool man at the shops for reworking. Usually drill bits of this kind can be reground and put to further use, or reduced to the next smaller size and used in the shop drill presses.

The other point deserving attention is the disposition of obsolete high-speed steel. Dealers have offered very attractive prices for the odd sizes of steel which have accumulated in storehouses owing to past changes in shop practices. One railroad system found that, by making an inexpensive set of dies, most of this valuable high-speed steel of obsolete sizes could be worked up into drill bits, thus saving the cost of new ones. After this stock was exhausted the same dies were used in making drill bits of carbon steel. These were marked with a small white paint dot and trackmen were cautioned that drill bits so marked must not extend very far from the drill chuck and must be handled carefully when starting the hole and when the drill bit comes through the rail. In this manner very good success has been had in drilling with carbon steel drill bits, which cost only $0.14 each to make.

Another thing which receives considerable abuse in the hands of trackmen is the track chisel. This tool should be made only of crucible steel and should be of best quality. An ordinary operating division of three hundred miles will use 200 to 300 chisels per month dur-

ing the summer season. Every chisel failure means a delay to work and may even result in personal injury. Track chisels should be of good quality, and the tendency of purchasing departments to order the cheaper quality of track tools at the present time in an effort to offset the rise in prices does not always result in economy to the railroad. The accompanying illustration shows a track chisel which has seen many months of hard service and has been kept in shape for use by occasional grinding. With it is shown a comparatively new track chisel of cheaper quality, which broke under the hammer during the first half-hour of use and must be sent to the blacksmith shop for redressing.

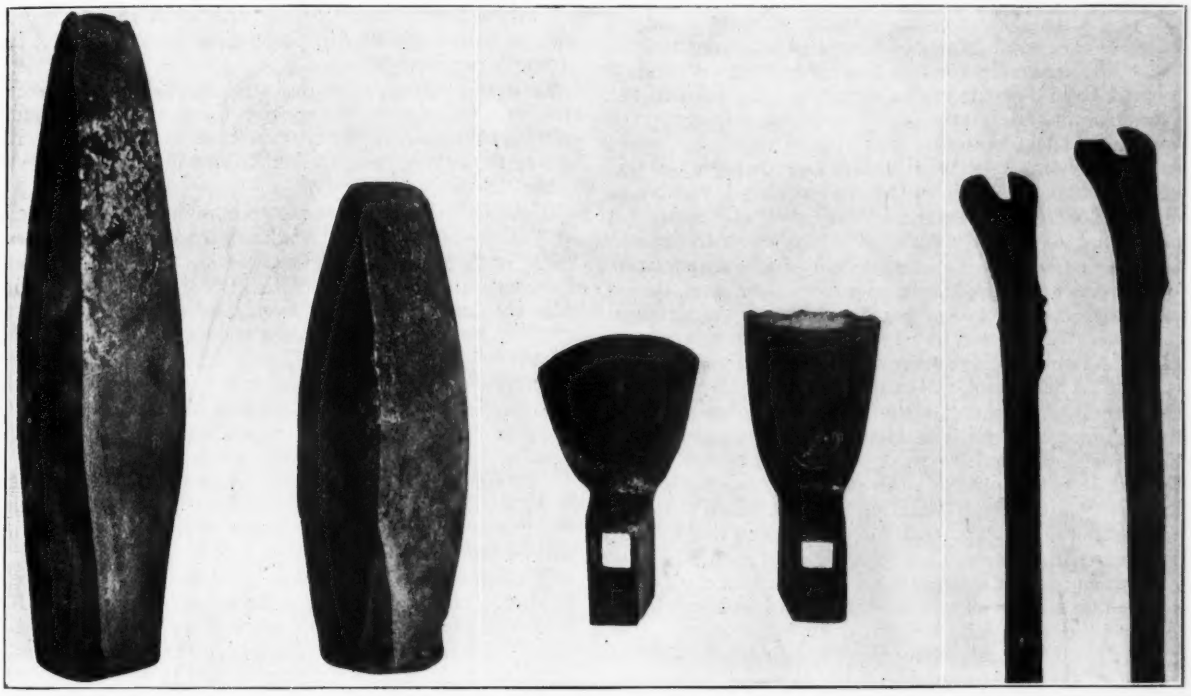
Track chisels should be handled carefully when in use. The men should be instructed to hold them accurately in the cut and in an upright position, perpendicular to the rail surface. A 12-lb. to 15-lb. sledge should be kept with the tool outfit and used in striking the chisels, rather than using a spike maul. A maul is too light for striking track chisels, and its small face renders it difficult to strike an accurate blow on the chisel head.

Adzes are frequently misused by trackmen. In the haste to prepare the ties ahead of a rail-laying gang the men frequently neglect to sweep the gravel off the ties before using the adz. Also one inexperienced in the use of this tool is very liable to strike the edge against a track spike or the rail flange. A tool of first-class quality will stand moderate abuse of this sort, but the cheaper tools, which the purchasing department is tempted to buy during this season will become nicked after a few minutes of use. The illustration shows the difference between a tool of good quality which has seen a great amount of service and a new tool of cheaper quality which became nicked in the first 15 min. of hard service.

It is a difficult matter to teach trackmen the proper manner of using a claw-bar. The average section man or spike puller in a rail gang does not think of attempting to use a claw-bar unless there is another man ready to strike it with a spike maul. Claw-bars are scientifically designed and will take hold of any ordinary track spike without being driven on with a maul. If the rail has cut into the tie an adz should first be used, or the wood removed by chipping with the sharpened end of the claw-bar. The price of an ordinary claw-bar has increased $0.75 during the past year, and the illustration shows what happens to a tool of cheap quality if it is abused in service.

A great deal can be accomplished in effecting economy in the use of track tools if a thoroughly-understood system of ordering and supplying new tools and caring for the tools in service, both while in use and when idle, is in effect. Foremen should make requisitions at regular intervals for their supplies of new tools, stating on the requisitions if the old tools will be available in exchange. Roadmasters should carefully scrutinize these requisitions and if the old tools are not available, suitable inquiry should be made. Supply cars should be fully stocked so that approved requisitions will be filled without shortage, and supply car clerks should be fully instructed in the importance of obtaining every old tool which the requisitions show will be available for exchange for the new ones specified on the orders. The responsibility for the failure to turn in the old tools in place of the new ones should rest with the roadmaster and not with the supply car clerks.

In thus gathering up an old tool for every new one furnished an opportunity is given to inspect the old tools and to form an opinion as to where they have given proper service and where they have received proper usage. It also affords the opportunity of assembling these tools at one place on the system where a sufficient quantity is thus brought together each month to warrant the employment of an expert tool repairer, who can work over the old tools and turn them out the equivalent of new ones. If the old tools are sent to each nearby shop point the repairs are treated as an odd job and are indifferently made, causing the trackmen to become prejudiced against the use of repaired tools.



A COMPARISON OF TOOLS IMPROPERLY AND CORRECTLY USED.

On the section, and especially on extra rail and ballast gangs, one employee should be delegated to the care of tools. It should be his duty to see that they are properly stored so as to be available when wanted, to see that edged tools are kept properly ground so as to always be in condition for service, and to see that tools are not scattered on the work and lost, but are kept ready for use and gathered up at the close of the day's work.

The annual expense for tools on a large railroad system ranges from $12,000 to $20,000 per month and is worthy of close attention at all times. This is especially true during this period of high prices.

SPECIFICATIONS FOR CONCRETE AGGREGATES*

BY CLOYD M. CHAPMAN,
Engineer of Tests, Westinghouse, Church, Kerr & Co., New York, N. Y.

CONCRETE is a cheap building material because it is composed largely of inexpensive aggregates, and for economic reasons these aggregates should be secured from deposits in the vicinity of the point of use. Whatever materials are locally available for aggregates must be used in the great majority of cases, for aggregates which must be transported long distances are no longer inexpensive. The material at hand capable of making concrete of fair quality will generally be used in preference to a better material which must be brought from a distance at considerable cost for transportation.

It is generally true that even a very poor sand, that is, one which compares very unfavorably with standard Ottawa sand when tested in 1 : 3 mixtures with cement, will give a suitable compressive strength if sufficient cement is used. When the only available sand is of such a quality it is necessary to increase the proportion of cement until the required strength is obtained. Our present specifications for sand require that it shall, when tested as prescribed, show a compressive strength approximately equal to that obtained with standard Ottawa sand. A rigid adherence to these specifications would mean that in many sections of the country no concrete work could be done without importing aggregates from a distance. The result is that the specifications are ignored in those localities and the work done without them.

On the other hand, where most excellent materials are available, the present specifications for sand do not permit of a variation of the proportions used, no matter how good the materials may be. For instance, some well-graded sands show strengths 40 per cent higher than that obtained with Ottawa sand in 1 : 3 mortar, and in 1 : 3½ or even 1 : 4 mortar show compressive strengths equal to that obtained with Ottawa sand in the proportion of 1 : 3. Yet this sand receives no credit for quality under the present form of specifications.

In order to cover and include all materials which are capable of producing concrete of the quality required for the particular service it is to perform it is only necessary to specify the result required instead of specifying the materials used. By specifying the results required and permitting the use of such materials as will produce these results when tested under specified and standardized conditions, it is possible not only to properly safeguard the product, but to permit the use of such materials as are available in each locality.

It is also true that in many cases the local materials are of such poor quality and would require such a large proportion of cement to fulfill the specifications that it would be economical to bring in better material even from a considerable distance, the saving in cement paying the freight. Specifications of this kind might take some such form as the following, in which all figures are purely arbitrary and in no sense proposed as a standard to be followed:

"The materials used shall be of such quality, and shall be used in such proportions as to produce a concrete which shall show a compressive strength of 2,500 (or 2,000 or 1,500 lb. per sq. in. at the age of 28 days, when tested in accordance with the standard methods of testing."

This form of specification is obviously susceptible to modification to cover varying conditions and qualities. For instance, to insure against a material which sets or hardens slowly, and consequently requires forms being kept in place an unusual length of time, the specifications may require a certain minimum strength to be attained in three days. When compressive strength is not the prime requisite, as for instance, in sea wall or tunnel work, the requirements as to impermeability or density may be inserted, either in place of, or in addition to, the strength requirement.

It would probably be desirable to add some further qualifying clauses to the specifications, such as the limit of size of particles, the character of the materials composing the aggregates, freedom from constituents liable to cause deterioration, etc.

The method at present most commonly employed, except in the cases of some of the railroads and on government work where aggregates, particularly the sand, are systematically tested, is practically to ignore the quality of materials, except the cement, and to specify, arbitrarily, proportions that will give good enough results with almost any aggregates. Wherein lies the incentive to a contractor or builder to use any better materials than the cheapest, if he is compelled by the specifications to use a certain arbitrary mix regardless of quality or material?

Any specifications for concrete aggregates which are to be used all over this country must be so drawn that any material which will make concrete of the required quality will be included. In operating under such specifications, it is of great importance that specimens of the concrete produced on the job be regularly made and tested. It is also of the greatest importance that a close day-to-day check be maintained on the quality of the materials used, to insure a reasonable uniformity, and to know that these materials are at least equal in quality to the materials used in arriving at the proportions required to give the quality of concrete called for in the specifications governing the work.

When the materials used on the job are from the same sources as those tested and from which tests the proportions to be used were determined, it is a simple matter to check up their qualities. Sand and stone from the same source do not vary much in quality, except in so far as quality is influenced by size of particles. Having once established by test the suitability of sand and stone for any grade of concrete and having determined the proper proportions in which to use them to attain a certain desired result, it is only necessary thereafter to see that the size, grading and proportions of these materials are reasonably constant to insure uniform quality of concrete. This fact is based on the well-established principle that, other things being equal, the aggregate whose granulometric-analysis curve most nearly approaches the line of maximum density will produce the best concrete. This makes it possible to determine with reasonable certainty which of two sands of the same kind and from the same source, but differing only in fineness, will make the better concrete.

*Abstracted from a paper presented before the convention of the American Society for Testing Materials at Atlantic City, N. J., June 27-30.

GENERAL NEWS DEPARTMENT

A COURT at Jamaica, N. Y., sentenced Michael Halleran, a crossing flagman of the Long Island Railroad to six months' imprisonment on July 11, for being intoxicated on duty.

THE SOUTHERN PACIFIC has announced an increase of wages of 25 cents per day for all section laborers except Mexicans and Chinese, employed on its lines in California, Nevada, New Mexico and Arizona.

THE UNION PACIFIC has converted a dining car into an experimental wireless telegraph station and has built other stations at Omaha, Neb., and Grand Island, with another one proposed at North Platte.

THE SOUTHERN PACIFIC has issued a notice that, owing to the Mexican situation, all of its lines south of the international border are closed and that the company is not in a position to accept shipments for points in Mexico via Nogales or Naco.

THE PENNSYLVANIA LINES have increased the average loading of cars carrying miscellaneous freight from 8,500 to 18,000 lbs. during the past four years by giving special attention to this subject. It is estimated that 1,693,847 cars have been saved in this period.

THE WESTERN RAILROADS moved 507.917,000 bushels of grain to primary markets in the six months ending June 30. This is the largest amount of this class of traffic ever handled and is an increase of 77,583,000 bushels, or 18 per cent over the amount handled in 1913, the previous high record.

THE NEW YORK, NEW HAVEN & HARTFORD placed an extensive embargo, effective at midnight June 29 and extending until midnight July 12, on all carload and less-than-carload traffic coming from connecting lines via Harlem River, N. Y., and Maybrook, because of heavy passenger business owing to troop movements and Fourth of July travel.

SERIOUS FLOODS during the last two weeks have interfered materially with the operation of the Southern, the Seaboard Air Line, the Carolina, Clinchfield & Ohio and other railways in North Carolina and adjoining states. The Southern suffered particularly in the vicinity of Asheville, N. C., a number of lines being closed for several days.

THE CHICAGO, BURLINGTON & QUINCY ran a special train from St. Paul to Chicago recently, which was completely equipped with telephones in every car and in every berth. The train comprised 12 cars, including a diner and a car equipped for band concerts. The telephones installed were of the automatic type. The train carried a party of Shriners to a convention at Buffalo.

THE AMERICAN SOCIETY FOR TESTING MATERIALS at its annual convention held at Atlantic City, N. J., June 27 to 30, adopted specifications for steel tie plates, track spikes, and screw spikes. While similar in many details to the specifications for the same material adopted by the American Railway Engineering Association three years ago, they vary from the original specifications in several important details.

THE BALTIMORE & OHIO uses a mailing envelope 5 in. by 11½ in. for railway business, which has 23 lines for addresses on each side, enabling it to be used 46 times. Each address is scratched out after being used. The Atchison, Topeka & Santa Fe uses a similar envelope with an open window, the letters being folded so as to show the address after they are placed in the envelope and requiring no address on the outside.

GOVERNMENT OWNERSHIP OF RAILWAYS IN CANADA, as reflected by the management of the Intercolonial and the Prince Edward Island railways, shows some interesting results. In the 47 years in which the Intercolonial has been operated by the Dominion government its earnings have exceeded its operating expenses in 22 years, the total combined net earnings for these years being $1.967,000. In the other 25 years its operating expenses have exceeded its earnings, and its combined deficits have been over $11,500,000, leaving a net deficit of $9,500,000, without allowing anything for taxes or interest. The total operating deficit of the Prince Edward from 1875 to 1914 amounted to $3,280,000, or a total for the two roads of approximately $12,800,000. If taxes and interest on the investment were allowed at the same rate that a privately owned railway has to pay this deficit would become much larger.

THE INDIANA APPELLATE COURT holds that an action for benefits against a railway employees' relief association is void under the Indiana statute of 1907, prohibiting railways from maintaining any relief association the rules of which require an employee to waive personal injury claims on becoming a member.

THE MINISTER OF WAYS OF COMMUNICATION in Russia has proposed that women be installed as assistant station masters in fourth-class stations and sidings because of the shortage of men, and the satisfactory results which have followed the employment of women elsewhere. The necessary conditions of such employment are that the women should be properly trained in a railway traffic school and should not be under 25 years.

THE PENNSYLVANIA RAILROAD has received responses to the call issued by S. C. Long, general manager, indicating that at least 50,000 of the employees are ready for special duty to prevent interruption in service in case of a strike among the engineers, firemen, conductors and trainmen. Included among these are some of the train service employees, a majority of the shop employees and many of the pension employees.

THE PENNSYLVANNIA RAILROAD has authorized an appropriation of not to exceed $100,000 to be expended for the relief of the dependent families of employees who have enlisted in the army or navy through membership in the National Guard or otherwise, and who have been called into active service. Each case will be considered on its own merits and this fund will be directed into channels where there is an established necessity for its application.

THE ERIE has ordered three triplex articulated locomotives for use in pusher service on the Susquehanna Hill of the same design as one purchased recently, which has given satisfactory service. Each of these locomotives weighs 860,350 lb., with the wreight on drivers 766,350 lb. They are equipped with three sets of eight driving wheels, one set being placed under the tender, and they exert a tractive force of 160,000 lb. They are the largest engines built up to this time.

THE ATCHISON, TOPEKA AND SANTA FE has adopted a death benefit for its employees, effective July 1. By the terms outlined, it proposes to pay to the beneficiaries of each employee dying while in the company's service, and who has been in its emplov continuously for two or more years, a sum equal to 5 per cent of the pay received by him during the 12 months preceding his death, multiplied by the number of years of continuous service. In no case, however, will a benefit exceed $3,000 or be less than $250.

THE ACCOUNTING OFFICERS' ASSOCIATION has ascertained that the executive officers in charge of 85.3 per cent of the mileage of the country favor a change in the end of the present fiscal year from June 30 to December 31, as compared with 14.7 per cent opposing such a change. Of 31 state railway commissions of whom inquiries have been made, 20 favored the change, 6 will make the change if the Interstate Commerce Commission and other state commissions do likewise, 2 are opposed and 2 are non-committal.

THE INTERSTATE COMMERCE COMMISSION has issued its preliminary abstract of steam railroad statistics for the year ending June 30, 1915, covering the operations on 257,569.32 miles of line, including 11,279.64 miles operated under trackage rights, and a total mileage of all tracks of 391,141.51. This is an increase of 1,022.22 miles of line and 3,933.20 miles of track during the year. The roads report 65,099 locomotives, 55,705 passenger cars, 2.356,-338 freight cars and 95,934 cars in company service. The average number of employees for the year was 1,409,342 and their total compensation $1,164,844,430.

PERSONAL MENTION

GENERAL

E. V. SMITH, district engineer maintenance of way of the Baltimore & Ohio at Wheeling, West Va., has been appointed assistant division superintendent at New Castle, Pa.

J. G. BLOOM, division engineer of the Chicago, Rock Island & Pacific at Little Rock, Ark., has been appointed superintendent of the Amarillo division, with headquarters at Amarillo, Texas.

A. W. THOMPSON, formerly chief engineer of the Baltimore & Ohio and more recently vice-president in charge of operation, has been promoted to the position of vice-president in charge of traffic and commercial development of the Baltimore & Ohio System, with headquarters at Baltimore, Md.

ERNEST STENGER, who has been appointed general superintendent of the Union Pacific, with headquarters at Omaha, Nebr., was born at Colmar, Alsace, in 1865 and graduated from the University of Michigan in 1886. He entered railway service as a rodman with the Burlington & Missouri River in the same year. He was a draftsman with the Atchison, Topeka & Santa Fe from 1888 to 1890 and was assistant engineer with the Missouri Pacific for the next 10 years. From 1900 to 1907 he was a division engineer, assistant superintendent and division superintendent of the Union Pacific. He was then general superintendent of the Rio Grande Western until March, 1911, from which date until his recent appointment he was general manager of the St. Joseph & Grand Island at St. Joseph, Mo.

L. B. ALLEN, who has been appointed general superintendent of the Central general division of the Chesapeake & Ohio, entered railway service as a rodman on the Southern Railway in 1899 after graduating from Kentucky State College. From Aug. 1, 1899, to January 1, 1904, he was employed on location and construction on the Chesapeake & Ohio. He spent the following year in the office of the engineer maintenance of way, and from January 1, 1905, to January 1, 1910, he was division engineer of the Kentucky division, with headquarters at Ashland, Ky. On the latter date he was appointed engineer maintenance of way of the Kentucky general division and of the Chesapeake & Ohio of Indiana, with headquarters at Covington, Ky. He was appointed division superintendent at Huntington, W. Va., on January, 1914, which position he held until his recent promotion to general superintendent.

ENGINEERING

G. L. MARICK was appointed assistant office engineer of the Gulf, Colorado & Santa Fe on July 1, with headquarters at Galveston, Texas, this position being a newly created one.

H. O. KELLEY, division engineer of the Evansville & Indianapolis, with headquarters at Indianapolis, Ind., has been appointed engineer maintenance of way with headquarters at the same point.

DANIEL W. THROWER, district engineer of the Yazoo & Mississippi Valley, with office at Memphis, Tenn., has been appointed assistant valuation engineer of the Illinois Central and the Yazoo & Mississippi Valley, with headquarters at Chicago, Ill.

B. B. SHAW, assistant engineer of the Chicago, Rock Island & Pacific at Haileyville, Okla., has been appointed division engineer of the Arkansas division with headquarters at Little Rock, succeeding J. G. Bloom, appointed division superintendent at Amarillo.

WILLIAM TRAPNELL, division engineer maintenance of way of the Baltimore & Ohio at Cumberland, has been appointed district engineer maintenance of way at Wheeling, W. Va., succeeding E. V. Smith, who has been appointed assistant superintendent at Newcastle, Pa.

FRED TAPLEY has resigned as assistant engineer of the Canadian Pacific to accept a similar position with the Canadian Government Railways (Intercolonial), at Moncton, N. B. H. R. Miles, resident engineer at Sudbury, Ont., succeeds Mr. Tapley, and V. T. Boughton, resident engineer at Chapleau, Ont., succeeds Mr. Miles at Sudbury.

CHARLES F. HINCHMAN, assistant engineer, maintenance of way of the Cleveland, Cincinnati, Chicago & St. Louis at Mt. Carmel, Ill., has been appointed engineer maintenance of way of the newly created Indianapolis terminal division, with headquarters at Indianapolis, Ind. Mr. Hinchman was born at Detroit, Mich., on December 21, 1882, and graduated from the University of Michigan in 1904. He first entered railway service on November 11, 1908, as assistant on the engineering corps of the Big Four. From 1909 to 1911, he was a laborer on interlocking and bridge gangs of the same road, and on the latter date again became assistant on the engineering corps. He was appointed assistant engineer maintenance of way, with headquarters at Mt. Carmel, Ill., on January 1, 1914. His appointment as engineer maintenance of way of the Indianapolis terminal division was effective on July 1, 1916.

ARTHUR E. OWEN has been appointed chief engineer of the Central Railroad of New Jersey, with headquarters at New York, succeeding Jos. Osgood, deceased. He was born on January 19, 1876, at Montclair, N. J., and was educated in the Montclair high school and later attended Rutgers College, New Brunswick, N. J. In 1898 he began railway work as a draftsman in the tax agent's office of the Central Railroad of New Jersey at New York, and has been in the continuous service of that road ever since. In August, 1899, he was transferred to the chief engineer's office as a rodman, and the following November was appointed assistant engineer at Mauch Chunk, Pa. He was transferred in the same capacity to Jersey City in 1901, remaining in that position until January, 1907, when he was appointed principal assistant engineer.

ARTHUR E. OWEN

MILTON B. MORGAN, assistant engineer maintenance of way of the Illinois Central and the Yazoo & Mississippi Valley, with office at Chicago, was appointed district engineer of the Yazoo & Mississippi Valley, with office at Memphis, Tenn., in place of Daniel W. Thrower, appointed assistant valuation engineer, effective July 15. Mr. Morgan was born at Alden Station, Luzerne County, Pa., on June 26, 1872, and graduated from Pennsylvania State College in 1898. He first entered railway service in August, 1898, in the maintenance of way department of the Illinois Central. From August, 1899, to June, 1911, he was employed in the construction department of the Illinois Central and the Yazoo & Mississippi Valley. From June, 1911, to June, 1912, he was assistant roadmaster of the Birmingham district of the Illinois Central, with headquarters at Corinth, Miss. On the latter date he was appointed roadmaster of the Tennessee division, with headquarters at Fulton, Ky. From November, 1913, to July 15, 1916, he was assistant engineer maintenance of way, with headquarters at Chicago, Ill.

SAMUEL MURRAY, whose appointment as chief engineer of the Oregon-Washington Railroad & Navigation Company, with headquarters at Portland, Ore., was announced in the last issue, was born at San Francisco, Cal., on June 20, 1880. He graduated from the University of California in 1902, and entered railway service with the Southern Pacific in August, 1902, after a short period of employment with the American Bridge Company. He was a draftsman and laborer on bridge construction for the Southern Pacific until 1906, when he was appointed chief draftsman in the office of the consulting engineer of the Harriman lines. In 1907 and 1908 he was bridge engineer of the San Pedro, Los Angeles & Salt Lake, and in 1909 he was appointed bridge engineer of the Oregon & Washington, with headquarters at Seattle, Wash. He continued to hold this position after this

road was merged with the Oregon-Washington Railroad & Navigation Company. Following the temporary retirement of J. R. Holman in September, 1915, he was made acting chief engineer, and upon Mr. Holman's permanent retirement he was appointed chief engineer, effective July 1, 1916.

R. N. BEGIEN has been appointed chief engineer of the Baltimore & Ohio System, with headquarters at Baltimore, Md., succeeding Francis Lee Stuart, resigned to engage in private practice. He was born in Boston, Mass., on March 15, 1875, and graduated from the engineering course at Harvard University in 1897. After leaving school he served for over three years as a member of the Nicaraguan Canal Commission, after which he spent a year in railway engineering work in Ecuador. He entered the employ of the Baltimore & Ohio on August 1, 1902, as assistant engineer at Somerset, Pa., and was appointed division engineer at Philadelphia in June, 1908. On May 1, 1910, he became assistant to A. W. Thompson, then chief engineer of the Baltimore & Ohio, continuing as his assistant when Mr. Thompson became general manager and later third vice-president on May 1, 1912. In December, 1912, he was appointed assistant general superintendent at Baltimore. He was promoted to general superintendent of the Baltimore & Ohio Southwestern at Cincinnati, O., in July, 1913.

R. N. BEGIEN

FRANCIS LEE STUART, chief engineer of the Baltimore & Ohio System, resigned, effective July 10, to engage in private practice in New York. He has had a wide experience in engineering work, being associated with important public, as well as railway projects. He was born at Camden, S. C., on December 3, 1866, and graduated from Emerson Institute, Washington D. C., in June, 1884. He entered railway service in the office of the consulting engineer of the Baltimore & Ohio in the same year, remaining with the road until 1887. After a varied experience in general engineering work he was assistant engineer with the Nicaraguan Canal Commission from December, 1897, to July, 1899, and later was division engineer with the Isthmian Canal Commission. In February, 1900, he returned to the Baltimore & Ohio as assistant engineer on location, being appointed district engineer in June, 1903, and engineer of surveys in March, 1904. One year later he was appointed chief engineer of the Erie, remaining in this position until January 1, 1911, when he was appointed chief engineer of the Baltimore & Ohio System, including the Cincinnati, Hamilton & Dayton. During the last five years the rehabilitation of a large part of the Baltimore & Ohio, including the construction of the Magnolia cut-off and the tunnels at Sand Patch, Pa., and Kingwood, W. Va., were under his direction. Mr. Stuart will devote his attention to the promotion of several patents for conveying machinery, some of which will be installed in the new export pier which the Baltimore & Ohio is now building at Curtis Bay, Baltimore.

FRANCIS LEE STUART.

F. F. HANLY, assistant engineer in the office of the engineer maintenance of way of the Baltimore & Ohio, at Baltimore, Md., has been appointed division engineer of the Cumberland division, with headquarters at Cumberland, Md. Mr. Hanly was born at Shelbina, Mo., on November 21, 1886, and graduated from the University of Missouri. Previous to entering railway service he was employed by the United States government as recorder on a drill boat locating locks and dams on the Ohio river. In September, 1909, he entered the service of the Baltimore & Ohio Southwestern as an assistant on the corps of the maintenance of way department. From September, 1911, to December, 1914, he was assistant engineer in the office of the engineer maintenance of way of the Baltimore & Ohio at Baltimore, Md. From the latter date until September, 1915, he was assistant division engineer of the Baltimore division, with office at Baltimore. From September, 1915, until June 1, 1916, he was again assistant engineer in the office of the engineer maintenance of way at Baltimore.

F. F. HANLY.

W. R. ARMSTRONG, general manager and chief engineer of the Salt Lake & Utah, has been appointed engineer maintenance of way of the Union Pacific, with office at Omaha, Neb., effective August 1. Mr. Armstrong has had 25 years of railroad experience, both as an engineer in charge of construction and maintenance of way and as an operating officer. Prior to coming to the Oregon Short Line in 1905, he was connected with various lines in the Middle West. During his first year with the Oregon Short Line he was engaged in special engineering work. In the following year he was placed in charge of the construction of the Yellowstone Park branch. He was also in charge of the extension from Huntington, Ore., down the Snake River canyon, to Homestead. In 1908 Mr. Armstrong was made superintendent of the Montana division, which position he held until 1913, when he was appointed general manager and chief engineer of the Salt Lake & Utah, then under construction.

W. R. ARMSTRONG.

WILLIAM G. ARN, roadmaster of the Indiana division of the Illinois Central, has been promoted to assistant engineer maintenance of way of the Illinois Central and the Yazoo & Mississippi Valley, with office at Chicago, to succeed Milton B. Morgan, promoted, effective July 15. Mr. Arn was born at Terre Haute, Ind., in 1877, and graduated from Rose Polytechnic Institute in 1897. His first railway experience was with the Louisville & Nashville as building inspector during the construction of the Nashville union station and terminal. In November, 1900, he was appointed assistant division engineer of the same road, with headquarters at Montgomery, Ala., and later he was made assistant engineer at New Orleans, La., in charge of second-track construction and terminal improvements. Later he was made acting roadmaster of the New Orleans and Pensacola divisions and subsequently roadmaster of the Cumberland Valley division. He then entered the service of the Missouri Pacific. After working for a short time as assistant engineer in the general offices

of the Missouri Pacific at St. Louis, Mo., he entered the employ of the Illinois Central in March, 1907, as assistant engineer in charge of the construction of terminals at Birmingham, Ala. From April, 1908, to August, 1909, he was assistant engineer of the Birmingham division, and on the latter date was placed in charge of the reconstruction of passenger terminals at Louisville, Ky. From June, 1910, to August, 1912, he was engaged in miscellaneous work in the general offices at Chicago, after which he was given charge of the construction of the Grand Central station and track elevation at Memphis, Tenn. From November, 1913, to July 15, 1916, he was roadmaster of the Indiana division at Mattoon, Ill.

TRACK

JOHN CALLOWAY has temporarily succeeded John Y. Burke, deceased, as roadmaster on the Texas & Pacific.

M. P. Fox has been appointed supervisor of the Baltimore & Ohio at Washington, Pa., in place of T. S. Pattison, promoted.

D. V. O'CONNELL has been appointed roadmaster of the Chicago & Northwestern at Tracy, Minn., to succeed Frank Thiewes, effective July 12.

T. J. JOYNER, general roadmaster of the Atlantic Coast Line at Jacksonville, Fla., has transferred his headquarters to Lakeland, Fla., effective July 1.

R. C. VIOLETT, roadmaster of the Chicago, Burlington & Quincy at Aurora, Ill., has been appointed roadmaster and assistant trainmaster, with headquarters at Streator, Ill.

P. D. FITZPATRICK, valuation engineer of the Central Vermont at St. Albans, Vt., has been appointed general roadmaster, in addition to his other duties, succeeding W. P. Elrod, resigned.

H. S. BADDERS has been appointed master carpenter of the North Carolina division of the Seaboard Air Line, with headquarters at Hamlet, N. C., in place of W. J. Galloway, resigned.

FRED B. OREN, superintendent of the New Orleans division of the Yazoo & Mississippi Valley, with office at Vicksburg, Miss., has been appointed roadmaster of the Indiana division of the Illinois Central, with office at Mattoon, Ill., succeeding William G. Arn, promoted, effective July 15.

T. B. KENNEDY, assistant roadmaster of the Norfolk & Western at East Radford, Va., has been transferred to Pulaski, Va., with jurisdiction over the line from New River to Bristol and the North Carolina branch, with headquarters at Pulaski, Va. T. S. Faulkner has been appointed assistant roadmaster between Roanoke and Bluefield, with headqurters at East Radford, Va., succeeding T. B. Kennedy.

J. W. THOMAS, whose appointment as roadmaster of the Norfolk & Western, with headquarters at Wilcoe, W. Va., was announced in the July issue, was born at Lebanon, Va., on December 28, 1888. He received a high school education at Lebanon and entered railway service on June 1, 1904, as a section and extra-gang laborer on the Norfolk & Western. On March 1, 1906, he was made section foreman, and on September 1, 1908, was promoted to assistant extra-gang foreman. He was later made extra-gang foreman, and on May 24, 1916, was promoted to roadmaster at Wilcoe, W. Va.

J. P. COSTELLO, whose appointment as inspector of track, western lines, Atchison, Topeka & Santa Fe, with headquarters at La Junta, Colo., was announced in the last issue, was born at Osborne, Ohio, on March 3, 1882. He was educated at Osborne high school and at Purdue University, where he took the course in civil engineering. He first entered railway service in March, 1898, as a section hand on the Erie. In March, 1903, he was appointed section foreman on the same railroad. In 1905 he entered the employ of the Cleveland, Cincinnati, Chicago & St. Louis as foreman on second-track construction. In the following year he was made extra gang foreman, and from 1909 to 1910 he was rodman for that road. He was transitman on the Big Four from 1910 until 1912, when he was appointed rail inspector of the New York Central lines, with headquarters at Gary, Ind. From June, 1912, to December, 1912, he was assistant supervisor on the Baltimore & Ohio, and from the latter date until August, 1913, supervisor. From 1913 up to the time of his recent appointment as track inspector, he was roadmaster of the Atchison, Topeka & Santa Fe at Pueblo, Colo.

BRIDGE

J. H. GROGG has been appointed assistant master carpenter on the Norfolk division of the Norfolk & Western, with headquarters at Lynchburg, Va.

GUSTAV A. HAGGANDER has been appointed bridge engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, succeeding C. H. Cartlidge, deceased. He was born at Sioux City, Iowa, on January 30, 1885. He obtained his technical education at the Armour Institute of Technology, Chicago, from which he graduated in 1907. Following graduation he entered the employ of the Chicago, Burlington & Quincy as a draftsman in the office of the bridge engineer, later being a concrete inspector and a designer until June 10, 1910, when he was made office engineer. From July, 1912, to July 1, 1916, he was assistant bridge engineer of the lines east of the Missouri river, with office at Chicago, Ill. As bridge enginer of the Burlington System he will continue to have his headquarters at Chicago.

G. A. HAGGANDER

WALTER SCHLINKERT, whose appointment as supervisor of scales of the Illinois Central, with headquarters at Centralia, Ill., was announced in the July issue, was born at Centralia on June 8, 1885. He was educated in the public schools of his native city and first entered railway service on May 19, 1902, as a scale machinist apprentice. On May 19, 1906, he was made scale inspector and remained in that position until December, 1913, when he was promoted to assistant supervisor of scales. On June 1, 1916, he was appointed supervisor of scales, succeeding Fred Schlinkert, deceased.

CHARLES RICHARD KNOWLES, whose appointment as superintendent of water service of the Illinois Central and the Yazoo & Mississippi Valley was announced in the last issue, was born at La Porte, Ind., on July 7, 1879. He was educated in private schools and entered railway service on January 1, 1900, as assistant foreman of water service of the Kentucky division of the Illinois Central. From March 1, 1902, to July 1, 1906, he was foreman of water service on various divisions of the Illinois Central. On the latter date he was appointed inspector of water service of the Illinois Central and the Yazoo & Mississippi Valley, with office at Chicago, Ill., and continued to hold that position until April 1, 1912, when he was appointed general foreman of water works. On June 16, 1916, he was promoted to superintendent of water service, with headquarters at Chicago, Ill.

CHARLES RICHARD KNOWLES

FRANK C. WORBS has been appointed assistant engineer in charge of bridge and building work of the Wheeling & Lake Erie, with headquarters at Cleveland, Ohio. He was born at Medina, Ohio, on October 23, 1887, and graduated from the Case School of Applied Science in 1911. He entered railway service in the bridge department of the Wheeling & Lake Erie on February 18, 1913. After 19 months with the Wheeling & Lake Erie, he took charge of field work on the Brooklyn-Brighton bridge, a reinforced concrete arch structure, with a

total length of 1,726 ft., built in Cleveland by Cuyahoga County. After the completion of this work he re-entered the service of the Wheeling & Lake Erie, taking the place of E. U. Smith, assistant engineer, resigned to become associated with the Samuel Austin Sons Company, contractors.

ROBERT FARNHAM JR., assistant to the engineer of bridges and buildings of the Pennsylvania R. R. at Philadelphia, Pa., has been appointed assistant engineer of bridges and buildings, and his former position has been abolished. He entered the service of the Pennsylvania in 1903 as transitman and later in the year became assistant engineer of construction in charge of the grade-crossing elimination work in Washington, D. C. In 1910 he was transferred to Broad Street Station, Philadelphia, and in 1913 he was appointed assistant to the engineer of bridges and buildings.

ARTHUR ENGH has been appointed assistant bridge engineer of the Chicago, Burlington & Quincy lines east of the Missouri river. He was born at Chicago, Ill., on June 9, 1885. Prior to entering railway service he was employed by Ralph Modjeski and the American Bridge Company. From August, 1905, to 1908, he did detailing and designing work in the bridge department of the Burlington. He was then made office engineer, being temporarily relieved of these duties in 1914 to become office engineer of the Paducah & Illinois, in charge of the design of the Metropolis (Ill.) bridge across the Ohio river. In 1915 he again became office engineer of the Burlington, in charge of the design and preparation of plans for a double-track bridge across the Missouri river at Kansas City. As assistant bridge engineer he will have headquarters, as heretofore, at Chicago, Ill.

PURCHASING

R. H. ADAMS has been appointed assistant purchasing agent of the San Pedro, Los Angeles & Salt Lake.

E. A. PAUL has been appointed purchasing agent of the New Orleans Great Northern, with office at New Orleans, La.

WILLIAM G. O'FALLON has been appointed purchasing agent of the Terminal Railroad Association of St. Lous, succeeding J. E. Williams, Jr., assigned to other duties.

ISAAC B. THOMAS has been appointed assistant purchasing agent of the Pennsylvania Railroad, with office at Philadelphia, Pa. He was born at West Chester, Pa., on June 26, 1872, and graduated from Sheffield Scientific School, Yale University, in 1892. Later in the same year he entered the service of the Pennsylvania Railroad as an apprentice at the Altoona shops. Since that time he has held various positions in the mechanical department, being appointed superintendent of motive power of the Erie division and of the Northern Central at Williamsport, Pa., on May 1, 1911, which position he held at the time of his recent appointment as assistant purchasing agent.

OBITUARY

JOHN Y. BURKE, roadmaster on the Texas & Pacific, died on June 25.

THOMAS TROY, supervisor of the Chicago & Alton at Springfield, Ill., was killed on July 18, near Lexington, Ill., while riding on a motor car.

FRED H. WHITE, purchasing agent of the Duluth, Missabe & Northern, with office at Duluth, Minn., died at that city on July 17, after an illness of two weeks following an operation for carbuncles.

ALEXANDER DOIG, a pioneer master carpenter of the Chicago & Northwestern, died at his home in Winona, July 22, at the age of 77 years. Mr. Doig was born in Dundee, Scotland, on June 19, 1839, and came to the United States in 1855. He began work with the Chicago & Northwestern in 1865 and was appointed assistant superintendent of bridges between Mankato, Minn., and Marshall in 1874. He was made superintendent of bridges and buildings on the Minnesota division in February, 1877, and in 1901 his jurisdiction was extended over the Dakota division. He retired from active service about seven years ago. During his long connection with the Minnesota division of the Northwestern he had charge of the construction of practically all of the existing structures between Winona, Minn., and Watertown and Huron, S. D.

DON JUAN WHITTEMORE, consulting engineer of the Chicago, Milwaukee & St. Paul and for nearly 50 years its chief engineer, died at his home in Milwaukee, Wis., on July 16, at the age of 86 years. He was born at Milton, Vt., in 1830, and was educated at Bakersfield Academy in the same state. He entered railway service in 1847, in the engineering corps of the Vermont & Canada. In 1849 he was appointed assistant to the chief engineer in charge of the construction of this line between Swanton, Vt., and Rouse's Point, N. Y. Upon the completion of this road he was appointed assistant engineer in charge of a division of the Great Western of Canada, and in 1852 left that road to become contractor's engineer in building the Central Ohio between Zanesville, Ohio, and Wheeling, W. Va. From July, 1853, to 1857, he was assistant chief engineer of the La Crosse & Milwaukee, and from the latter date until 1860 was chief engineer and director of the Southern Minnesota. In the winter of 1860-1861, he was chief assistant engineer of the Ferrocarril Del Oeste in Cuba. He then reëntered the service of the La Crosse & Milwaukee as chief assistant to the chief engineer, and in 1863, when the La Crosse & Milwaukee was merged into the Chicago, Milwaukee & St. Paul he was made chief engineer of the St. Paul, in which capacity he served actively until December 6, 1910, when he retired. Since 1910, he has continued to serve the St. Paul in a consulting capacity.

DON JUAN WHITTEMORE

JOSEPH O. OSGOOD, chief engineer of the Central of New Jersey, died suddenly in the Broad street station, Newark, N. J., on June 28. He was born at Cohasset, Mass., on December 28, 1848, and attended Massachusetts Institute of Technology. He began railway work in July, 1865, as a rodman on the construction of the Eastern Shore Railroad, now a part of the New York, Philadelphia & Norfolk. From 1874 to 1878 he was engaged in engineering work with the Massachusetts Board of Harbor Commissioners at Boston. For the next three years he was employed on construction work by the Atchison, Topeka & Santa Fe in Colorado and New Mexico. He went to San Diego, Cal., in September, 1881, where he was engaged in the construction of the California Southern for two years. From 1883 to 1884 he was chief engineer of the Boston, Hoosac Tunnel & Western, after which he was out of railway work for about one year. He was appointed chief engineer of the Toledo, St. Louis & Kansas City, now a part of the Toledo, St. Louis & Western, in April, 1886, serving subsequently as a director of that road. While with this line he was in charge of the work of changing it from narrow to standard gage. In January, 1888, he was appointed chief engineer of the Lake Shore & Michigan Southern, resigning in March, 1889, to engage in consulting railway engineering work in New York. On July 17, 1901, he was appointed chief engineer of the Central Railroad of New Jersey, which position he held until his death, as noted above.

JOSEPH O. OSGOOD

CONSTRUCTION NEWS

THE ATCHISON, TOPEKA & SANTA FE is planning to construct a passenger and freight station at Carrollton, Mo., to cost about $25,000. The structure will be 190 ft. by 30 ft., and will have a brick exterior, tile roof and concrete floor.

THE CHICAGO & NORTHWESTERN has awarded a contract to Leyden & Ortseifen, Chicago, for the construction of a brick depot at Menominee, Mich., to cost about $14.000.

THE CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS will soon open bids for a brick and concrete station and office building 40 ft. by 150 ft., two stories in height, to be built at Mattoon, Ill.

This road has awarded a contract to the Walsh Construction Company, Davenport, Iowa, for the elimination of four street crossings between First avenue and Seventeenth avenue, Columbus, Ohio. The project involves about 180,000 cu. yd. of embankment and 10,000 cu. yd. of concrete work. The tracks will be elevated an average of six feet and the streets will be depressed. Four steel through girder bridges with solid floors will be erected.

THE CHICAGO, MILWAUKEE & ST. PAUL is checking up original surveys made in 1914 on an extension from Grassrange, Mont., to Winnett, about 20 miles, and expects to begin construction work this summer.

The St. Paul has started the construction of extensive new terminal facilities at North McGregor, Iowa. The work includes a 22-stall roundhouse, a 90-ft. turntable, a 100,000-gal. water tank, a 154-ft. cinder pit, a sandhouse, a coaling station, a powerhouse 50 ft. by 63 ft., a blacksmith and machine shop 40 ft. by 60 ft., a car repair building 40 ft. by 80 ft., and an entirely new yard layout, involving 15 miles of track. The project also involves an extensive channel change of Giard creek and the raising of the yards above the flood level. Outside of part of the grading which has been contracted to Morris, Shepherd & Dougherty, St. Paul, Minn., all of the work is to be done by company forces.

THE COLORADO, KANSAS & OKLAHOMA contemplates the extension of its line south across western Kansas to Forgan, Okla.

THE DELAWARE, LACKAWANNA & WESTERN is carrying out improvements between Brick Church, N. J., and Mountain Station, on the Morristown line, to eliminate 26 grade crossings through the city of Orange. The work includes the construction of 23 reinforced concrete flat-slab bridges, one steel bridge, a new brick station at Orange and one at Highland avenue, and the elimination of two grade crossings at Milburn. When these improvements are completed, the company will have three tracks from Newark to Milburn, with no grade crossings between Newark and Summit, with the exception of the section through East Orange, on which 12 grade crossings are yet to be eliminated.

THE DULUTH, MISSABE & NORTHERN has awarded a contract to Macleod & Smith for the construction of a 100-ft. reinforced concrete roundhouse, designed for 60 stalls, one-half of which is now being built.

THE EAGLE PASS & ARANSAS PASS is a new company which has been organized at Aransas Pass, Tex., to build a line between Aransas Pass, Tex., and Eagle Pass, a distance of about 250 miles. The proposed route is through a ranch region that of late years has undergone considerable agricultural development. Bonuses aggregating $50,000 in cash and considerable land have been pledged in aid of the project.

THE FT. SMITH, SUBIACO & EASTERN will extend its line from Scranton, Logan County, Ark., to Dardanelle, a distance of about 15 miles. The work will be done by company's forces, and the contracts for rail and other material have already been made.

THE GREAT NORTHERN is building 36 miles of new line from Wildrose, N. D., west to the Montana border.

This road has awarded a contract to Morris, Shepherd & Dougherty, St. Paul, Minn., to build an extension from Wildrose, N. D., to Grenora, 36 miles, at an estimated cost of $675,000. About 5 per cent of the work has been completed.

THE MISSOURI, KANSAS & TEXAS has awarded a contract to the American Construction Company, Houston, Tex., for the erection of a reinforced concrete cotton platform at Houston, to cost about $50,000.

THE MISSOURI PACIFIC expects to begin work within 30 days on the construction of passenger and freight stations at Joplin, Mo. The freight house will be of brick construction and the passenger station will have a stone and brick exterior with a tile roof. The cost of the work is estimated at about $50,000.

This road has awarded a contract to the List & Gifford Construction Company, Kansas City, Mo., for from 60,000 to 80,000 cu. yd. of bank widening work between Dupo, Ill., and Roots, on the Illinois division, a distance of about 45 miles. The work has been sub-let to the List & Bagwell Construction Company, which concern now has it under way.

It is preparing plans for the construction of a brick passenger station at Bismarck, Mo., to cost approximately $15,000, and one at De Soto, Mo., to cost $17,000. A new passenger station has been started by this road at Clarksville, Ark., which will cost about $15,000. These plans include the rearrangement of tracks and the construction of the necessary platforms.

THE MONTANA EASTERN, a subsidiary of the Great Northern, has awarded a contract to A. Guthrie & Co., St. Paul, Minn., for the completion of a line between Lewistown, Mont., and Higgins, 25 miles. About half of the line was constructed in 1913.

THE NEW YORK, NEW HAVEN & HARTFORD has submitted plans for approval to the Boston authorities for the enlargement of the cut leading to the freight terminals at Boston to provide for four tracks instead of two tracks. The estimated cost of this work is $829,000.

THE NORTHERN PACIFIC has authorized the construction of a branch line from Dixon, Mont., to Polson, 33.75 miles in length, involving about 23,000 cu. yd. of material per mile, and the building of a few small timber bridges. The work has not been started, nor have bids been asked for.

THE OREGON SHORT LINE will complete an extension from Marshfield, Idaho, to Idahome, a distance of 19 miles, track-laying work to be done by company forces. Grading of this line was completed in 1911.

THE PENNSYLVANIA LINES will relocate their line adjacent to the north bank of the Ohio river from a point a short distance east of Glen Osborne station, Pa., through Sewickley and Edgeworth Boroughs to a point west of Shields station, a distance of 2.7 miles. This will be a four-track line and will involve about 550,000 cu. yd. of fill and 105,000 cu. yd. of excavation. It will have a maximum curve of 1 deg. 45 min. and maximum grades of 0.112 per cent east bound and 10 per cent west bound. There will be five undergrade street crossings and five passenger station subways, involving the placing of 13,000 cu. yd. of concrete and the erection of 18,000 sq. ft. of steel solid-floor bridges. A new freight and passenger station layout will be constructed at Sewickley.

THE PORT BOLIVAR IRON ORE RAILWAY is locating a route for an extension from Big Cypress Bridge, three miles north of Ore City, Tex., to Avinger, a distance of 10 miles. The road will connect with the Missouri, Kansas & Texas at Avinger.

THE ST. LOUIS & SAN FRANCISCO will build a frame roundhouse, a car repair shed and other buildings at West Tulsa, Okla., which, together with a 100-ft. turntable, other mechanical facilities and yard tracks, will cost over $200,000.

This road also contemplates the construction of a ten-stall roundhouse, a 100-ft. turntable, mechanical department buildings and yard tracks at Oklahoma City, Okla., to cost about $200,000.

THE SOUTHERN is receiving bids for the masonry work on the bridge over the south channel of the James river, near Richmond, Va. The present bridge, which consists of five through pin-connected spans, is to be replaced by ten through girder spans, with new intermedate piers. A contract for the bridge proper will be let as soon as the piers are ready.

THE SOUTHERN PACIFIC is preparing plans for a 10-story office building to be constructed at the corner of Market and Spear streets, San Francisco, Cal.

This road has completed the work on a line from Hoover, Ore., southeasterly along the north fork of the Santian river for a

distance of 11 miles. It it not known when the line will be completed.

THE WHEELING & LAKE ERIE is constructing a belt line 3½ miles long at Canton, Ohio, to reach the new furnaces of the United Furnace Company. This line will cross Tuscarawas street with a double track under-grade crossing, to be constructed of reinforced concrete and steel beams. J. C. Carland, Toledo, Ohio, has the contract for the work, which is now practically 50 per cent completed.

THE WISCONSIN & NORTHERN is extending its main line from Shawano, Wis., to Black Creek, 24 miles. The contract for the grading has been awarded to P. W. O'Connor & Co., Grand Rapids, Mich. The track laying and the erection of bridges will be done by company forces. About 10,000 cu. yd. of material is being handled per mile, and about 300 cu. yd. of concrete will be placed in the construction of culverts. The maximum curvature is 2 deg. and the grade, southbound, 0.6 per cent, and northbound, 0.8 per cent. Three pile trestles totaling about 300 ft. in length will be constructed.

THE YAZOO & MISSISSIPPI VALLEY is preparing to raise the grade of its tracks from three to six feet for about 12 miles between Vicksburg, Miss., and the Yazoo river. The work will be done by company forces and will involve the handling of about 250,000 cu. yd. of materials. The company is also raising its grade for a distance of about 17 miles, south of Vicksburg, 14 miles of which will be on an entirely new line, including a new crossing over the Big Black river, and the handling of about 500,000 cu. yd. of material. H. W. Nelson Company, Chicago, Ill., have the contract for the grading.

STRUCTURAL STEEL

THE CHICAGO & WESTERN INDIANA has ordered 219 tons of steel from the American Bridge Company for an over-crossing with its own track at 87th street, Chicago.

THE ILLINOIS CENTRAL has ordered 465 tons of steel from the American Bridge Company for track elevation bridges in Chicago.

THE LEHIGH VALLEY has ordered 400 tons of bridge work from the American Bridge Company and 325 tons from another company for use at Waverly, N. Y., in addition to 400 tons from the Pennsylvania Steel Company for use at Sayre, Pa.

THE PENNSYLVANIA LINES have ordered 4,000 tons of steel from the American Bridge Company for a bridge across the Beaver river at Rochester, Pa.

THE PENNSYLVANIA RAILROAD has ordered 2,300 tons of bridge steel for 21 spans from the American Bridge Company and 1,200 tons for 17 spans from the Pennsylvania Steel Company.

THE SOUTHERN has ordered 500 tons of steel from the McClintic-Marshall Company for a bridge over the James river, in Virginia.

TRACK MATERIALS

THE FRENCH GOVERNMENT has ordered 14,000 tons of rails from the United States Steel Corporation.

THE HARRIMAN LINES have ordered 6,000 tons of tie plates.

THE RUSSIAN GOVERNMENT RAILWAYS are now negotiating for 50,000 kegs of track spikes.

THE RUSSIAN GOVERNMENT RAILWAYS have ordered from 425,000 to 450,000 tons of 67½-lb. rails and accessories from the mills of this country. Of this amount the United States Steel Corporation will roll about 200,000 tons, the Cambria Steel Company 165,000 tons, and the Lackawanna Steel Company 75,000 tons. This is probably the largest single rail order ever placed in this country, involving a total expenditure of between $22,000,000 and $23,000,000. The rails are to be delivered by July, 1917.

THE SEABOARD AIR LINE is in the market for 5,000 to 10,000 kegs of spikes.

THE SOUTHERN PACIFIC has ordered 80,000 tons of rails from the Tennessee Coal, Iron & Railway Co. for delivery during the second and third quarters during 1917.

THE WESTERN MARYLAND has ordered 2,250 kegs of track spikes.

SUPPLY TRADE NEWS

PERSONAL

D. E. GARRISON, president of the Corrugated Bar Company, of St. Louis and Buffalo, died on July 4, at his home in St. Louis, Mo., at the age of 77.

E. R. MARKER, district manager of the T. L. Smith Company, has opened new quarters at 609 Wells street, Milwaukee, Wis., where he has taken charge of the business of the company as Wisconsin representative.

WILLIAM M. HENDERSON, until recently assistant to the superintendent of the frog, switch and signal department of the Pennsylvania Steel Company at Harrisburg, Pa., has been appointed assistant works manager of William Wharton Jr. & Co., Easton, Pa.

HENRY FISCHER, sales agent at Chicago for the Verona Tool Works, of Pittsburgh, Pa., has been appointed general sales manager of the company, with headquarters at Pittsburgh, Pa. Mr. Fischer was born in Brooklyn, N. Y., on June 4, 1880. He was employed by the Shutt Improvement Company, railroad contractors, at St. Louis, Mo., from 1901 to 1903. From 1904 to 1911 he was in the engineering department of the Cleveland, Cincinnati, Chicago & St. Louis, at Cincinnati, Ohio, during the last three years of which time he was chief clerk to the chief engineer. From 1911 until July 1, 1916, he was sales agent of the Verona Tool Works at Chicago, in charge of the western territory, from which position he was promoted as noted above.

HENRY FISCHER

JOSEPH THAYER GILMAN, first vice-president of the Goodwin Car Company, New York, died on June 11 at the age of 52 years. He was born at Framingham, Mass., in 1864. When 20 years of age he went to India with C. H. Bailey & Company, importers of goat skins, returning in 1897 because of ill health. The following year he again went to India, this time to open a house for the Keen Sutterlee Co., Ltd. Upon his return from this trip he became associated with John M. Goodwin of the Goodwin Car Company. In 1898, however, he went back to India, opening a house in Calcutta for Burk Brothers of Philadelphia, manufacturers of Morocco. He returned to the United States and in 1903 again became associated with the Goodwin Car Company, becoming second vice-president and later first vice-president. At the time of his death he was in charge of the design and construction of the Goodwin car and made all contracts for their lease and sale.

JOSEPH THAYER GILMAN

WILLARD WILSON, assistant manager of sales of the Tennessee Coal, Iron & Railroad Company, has been appointed general manager of sales of the company, succeeding F. A. Burr, who resigned to become general manager of sales of the Ætna Explosives Company.

HENRY ALDEN SHERWIN, chairman of the board of directors of the Sherwin-Williams Company, died of heart failure on June 26, at his country place, near Cleveland, Ohio. Mr. Sherwin was born at Baltimore, Vt., on September 27, 1842, and began his business career at the age of 13. In 1862 he went to Cleveland, where he secured a position as a clerk and bookkeeper with a dry goods company. In July, 1866, he left this business to organize Dunham & Co., the name of which was changed to Sherwin, Williams & Co., in 1870, when E. T. Williams was taken into the firm. In 1884, this company was incorporated as the Sherwin-Williams Company. For the past few years he was chairman of the board of directors of the company, although not as active in the affairs of the organization as in former years. Mr. Sherwin was well known to the older men of the railway supply field. He began his career as a salesman by selling to the railroads. Mr. Sherwin established the first factory lunchroom to provide noon-hour lunches for employees, a plan which has since been adopted by many other industrial firms.

HENRY ALDEN SHERWIN

THOMAS M. DERICKSON, general manager of the F. B. Zieg Manufacturing Company, Frederickstown, Ohio, has been appointed general sales manager of the A. G. A. Railway Light & Signal Company, which has recently acquired the railway light and signal business of the Commercial Acetylene Railway Light & Signal Company, as noted elsewhere in these columns. Mr. Derickson was born at Meadville, Pa., in 1866. He served an apprenticeship in the Erie Shops at Meadville, Pa., but later studied civil engineering and was for a time employed in the engineering department of the Erie. Subsequently he engaged in railroad and land surveys in the south, being at one time general manager of the Lookout Incline Railway at Lookout Mountain. He was later sales manager of the Champion Iron Works, after which he became general manager of the Memphis district of the Bell Telephone Company, and subsequently general sales manager of the Galion Iron Works, Galion, Ohio. Since that time he has been general manager of the F. B. Zieg Manufacturing Company, as noted above.

THOMAS M. DERICKSON

WILLIAM H. YETMAN, for the past two years in charge of the western railroad department of the Pyrene Manufacturing Company, New York, has been appointed railroad sales manager of the company for the entire United States, with headquarters at Chicago. He succeeds E. L. Kent, who has resigned to become vice-president of the Metal Hose & Tubing Company. Mr. Yetman was formerly hydraulic engineer for the Bethlehem Steel Corporation. William D. Dorry will be in charge of railway sales in the territory east of Pittsburgh, with headquarters at New York.

GENERAL

THE LIDGERWOOD MANUFACTURING COMPANY, New York, moved its office at Seattle, Wash., from 807-809 Western avenue to new quarters at 63-65 Columbia street, on July 1.

THE RENSSALAER POLYTECHNIC INSTITUTE, at the recent commencement exercises, conferred the degree of Doctor of Engineering upon Robert W. Hunt, who has been a trustee of the institute since 1886, and has done much to further the interests of the school. At the same time a portrait of Mr. Hunt by Lewis Betts was presented to the institute. Mr. Hunt has contributed largely to the erection of some of the institute's new dormitories.

THE KENNICOTT COMPANY, of Chicago, Ill., was placed in the hands of receivers on July 12, and the Central Trust Company of Illinois was appointed receiver. Chauncey J. Blair, late president of the company, it is understood, was trying to float a bond issue for the purpose of obtaining more working capital at the time of his death last May. Further efforts to effect this purpose were unsuccessful and the receivership followed.

THE COMMERCIAL ACETYLENE RAILWAY LIGHT & SIGNAL COMPANY has sold out its railway light and signal business to the A. G. A. Railway Light & Signal Company and will confine its efforts to the sale of acetylene, changing the company's name to the Commercial Acetylene Welding Company, with offices at 80 Broadway, New York. The officers of the new company are: E. C. Benedict, president; F. S. Hastings, vice-president; M. J. Quinn, secretary and treasurer, and G. Mayer, assistant secretary and assistant treasurer. The directors include these officers, as well as Edward Beers, Robert S. Sharp, and A. V. Conover. M. M. Smith has been promoted to general manager.

THE BETHLEHEM STEEL COMPANY has announced the acquisition of the Pennsylvania Steel Company and the Maryland Steel Company, and their operation in the future under lease by the Bethlehem Steel Company. The general sales offices of these companies have been consolidated with those of the Bethlehem Steel Company. R. W. Gillispie, general manager of sales for the Pennsylvania and Maryland Steel companies at Philadelphia, and Paul Mackall, sales agent for the Bethlehem Steel Company in the Pittsburgh district and west, have been appointed assistant general sales agents at So. Bethlehem, Pa. Edward S. Knisely is general sales agent. R. E. Belknap, district sales manager of the Pennsylvania Steel Company at New York, has been transferred to Chicago as sales agent, and J. M. Price, sales agent in Chicago has been transferred to St. Louis.

TRADE PUBLICATIONS

LOCOMOTIVE CRANES.—The Brown Hoisting Machinery Company, Cleveland, Ohio, has issued a 64-page booklet describing in detail and illustrating the essential features of its locomotive cranes and special attachments. A large portion of the booklet is devoted to photographs of cranes engaged in a wide variety of operations. The book is instructive to present and prospective users of this type of equipment, particularly as it suggests many uses to which a crane may be put.

CABLE WAYS.—The Lidgerwood Manufacturing Company, New York, has issued an attractive 14-page booklet describing and illustrating its cable ways. The first 6 pages are devoted to a description of the cable ways and their development, with illustrations of special features. In the remaining 8 pages, illustrated descriptions are given of various construction jobs where they have been utilized.

DU PONT PRODUCTS.—The Du Pont companies have recently issued a 111-page book, 5 in. by 8 in. in size, giving a complete list of the products made by E. I. Du Pont de Nemours & Co., the Du Pont Fabrikoid Company, the Du Pont Chemical Company and the Arlington Company. The book contains a list of products arranged under the following heads: High explosives; low explosives; black blasting powder; sporting powders; explosives for military uses; miscellaneous commodities, blasting supplies, Fabrikoid; chemicals; Pyralin; special products and by-products. In each case a brief description of the commodity is given, followed by a list of its users and also its uses.

The Battle Cry of Pace

Speed and more speed is the battle cry of modern business. The automobile purrs it. The aeroplane hums it. The 20-hour flyer clicks it. The wireless snaps it. And the telephone speaks it.

¶ Speed and more speed is written across the noon-day sky in sooty black from a thousand belching chimneys. It gleams through the night from a thousand throbbing furnaces. And it gurgles from the churning waters in the wake of ocean greyhound fleets.

¶ "Speed and more speed," cries the child and we refine his clumsy toys. "Speed and more speed," says the citizen and we blast his subways and elevate his trains. "Speed and more speed," says the housewife and we fashion labor-saving devices. "Speed and more speed," shouts the builder and we shoot ribs of steel sky-highward.

¶ "Speed and more speed," calls the whole world and we whip our dormant energies, drive our mills faster and force our furnaces in our eagerness to respond to the battle cry of pace.

¶ And all this we do with little thought that far ahead of all this rush, this dash, this maddening crash, is the pace-maker —ADVERTISING.

Copyright, 1916, by Simmons-Boardman Publishing Co.

LIDGERWOOD HOISTS

Steam, Electric and Gasoline

For Pile Driving, Derricks, Bridge Erection, Coal Towers, Etc.
Draw Bridge Engines, Ballast Unloaders, Excavators, Cableways

Write for Catalogues

LIDGERWOOD MANUFACTURING CO.

96 Liberty Street, New York

Philadelphia Pittsburgh Chicago Seattle London, Eng.
3

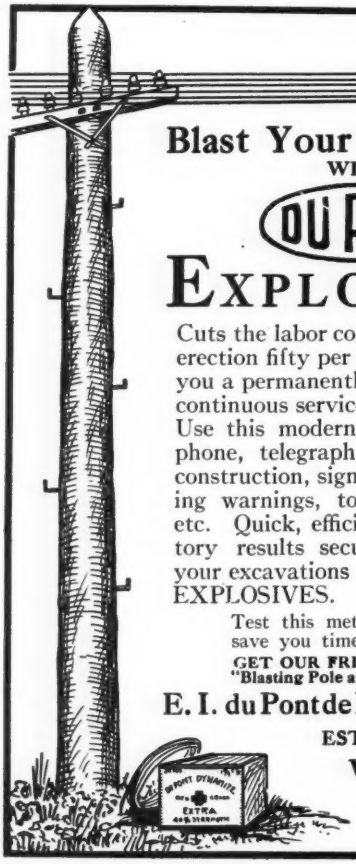
Employment Bureau

POSITION WANTED—Highly efficient, energetic trackman, twelve years' consecutive service with standard steam roads as section, extra gang and construction foreman, backed by college education, would consider offer of position as general foreman of construction or roadmaster. First-class references only. American, age 39 years, strictly temperate. Employed at present and for last few years as foreman by one of largest railway systems. Reasons for contemplating change: Not enough responsibility and action connected with present position. Address Box 1, *Railway Maintenance Engineer,* Transportation Building, Chicago.

An employment and classified advertising section will be incorporated in this publication whenever there is a demand for such service.

Use this section when seeking a new man, a new position, or when buying or selling second hand equipment.

Rate is 2c a word a month. Minimum charge $1.00. Remittance must accompany each order. Address Railway Maintenance Engineer, Classified Advertising Department, Transportation Bldg., Chicago, Ill.



Blast Your Pole Holes
WITH
DU PONT
EXPLOSIVES

Cuts the labor cost of pole and post erection fifty per cent, and insures you a permanently secure line and continuous service.
Use this modern method in telephone, telegraph and power line construction, signal systems, crossing warnings, tower foundations, etc. Quick, efficient and satisfactory results secured by blasting your excavations with DU PONT EXPLOSIVES.

Test this method. It will save you time and money.
GET OUR FREE BOOKLET: "Blasting Pole and Post Holes."

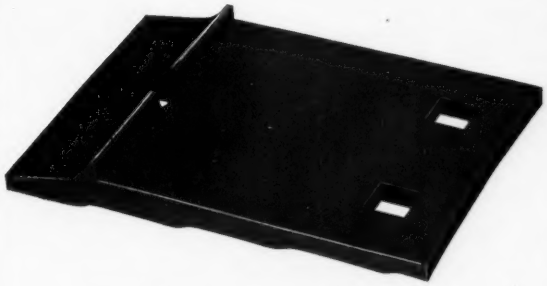
E. I. du Pont de Nemours & Co.
ESTABLISHED 1802
Wilmington, Delaware

WE SEE AROUND US many great advertising successes among our commercial fellows—great giant organizations, grown up almost over night, by the right use of the printed word.

Advertising successes are so numerous, on every hand, and in every line of business, that no thinking man attempts to explain them as the results of chance or coincidence.

Faith in advertising is founded on hard, cold facts.

Railway Maintenance Engineer
NEW YORK CHICAGO CLEVELAND



More than a mere Tie Plate—A safety device—An economic device—A device promoting easy riding Track. The

LUNDIE TIE PLATE

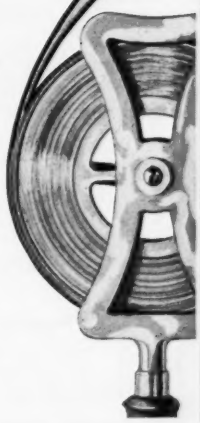
will more than pay for itself in saving of Rail and Wheel wear and in reduction of maintenance expense, as well as performing the usual functions of a Tie Plate.

JOHN LUNDIE, 52 Broadway, NEW YORK

Chicago Tape Stands All Kinds of Abuse

A railroad train going full speed over Chicago Steel Tape cannot spoil its usefulness.

This is a pretty good test for steel tape, but we make no limitation in the guarantee for Chicago Steel Tape.

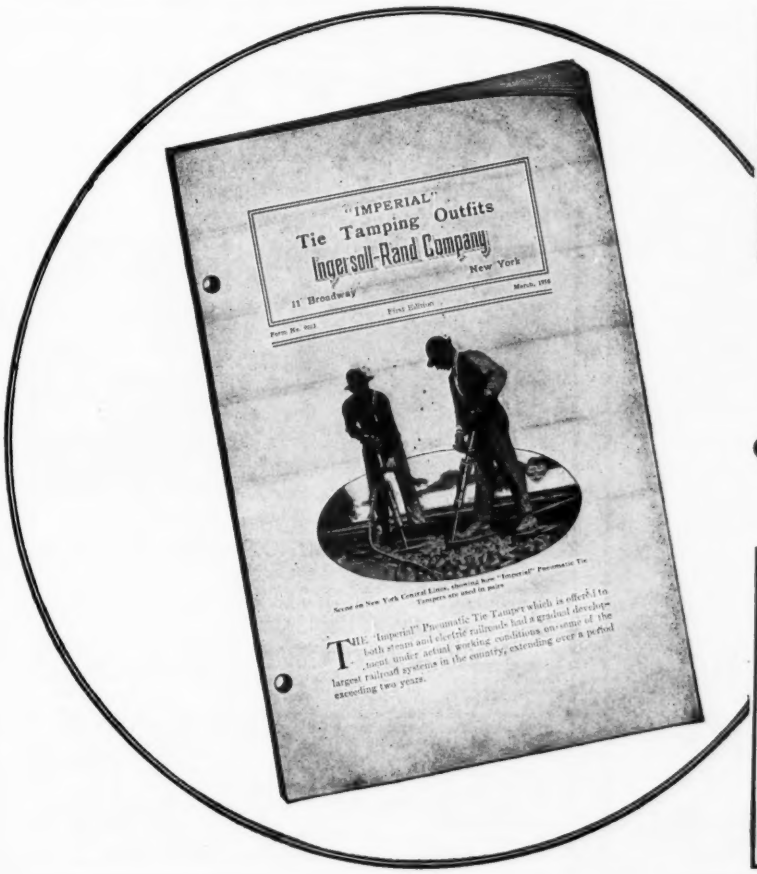


Repairs Free

If any of our tapes break, no matter how, we'll repair it free without argument of any kind.

Write for a copy of our Tape Booklet

Chicago Steel Tape Company
6229 Cottage Grove Avenue
CHICAGO



TRACK TAMPING

DID YOU GET YOUR COPY OF THIS BULLETIN?

INGERSOLL-RAND CO.:—
11 Broadway, New York

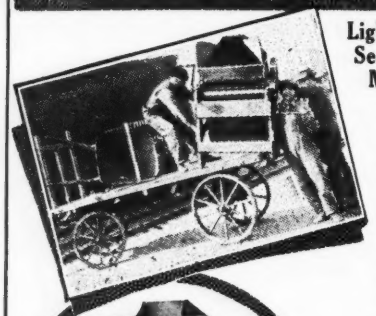
Send me my copy of your new bulletin No. 9023.

Name .....

Title .....

Address .....

Three Men Load It Easily—Northfield Hand Mixer



Light Batch Mixer For Section Crews And Maintenance Men

A perfected, light weight, light running concrete mixer specially adapted to railroad work. **A mixer that any crew can use.** Simple—no complicated parts—nothing to get out of order. Weighs but a trifle more than a third as much as any other satisfactory hand mixer. Strong. Convenient. Efficient. Durable.

Used And Approved By Railway Engineers

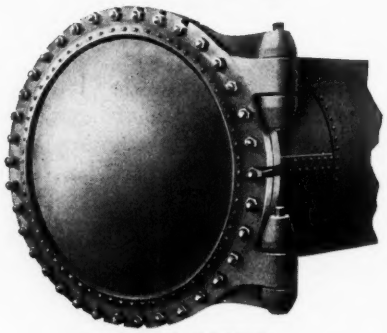
Northfield Mixers are a known success for railroad service. Used by section gangs and repair crews for all sorts of concrete jobs—piers, back walls, sidewalks, patch work, box culverts, pedestals, signal pits, turntable foundations and walls, etc. Proven a big saving—over 50c. a yard—over cost of hand mixing. A batch mixer—new mixing action—perfect mix. Turns out a 4 ft. batch every minute—30 to 60 yards a day with 5-man crew.

Investigate the Northfield, now. 30 Days' Free Trial Allowed to Railroad Companies. Write for Catalog.

NORTHFIELD IRON CO., 450 Nico Bldg. Northfield, Minn.

Tie Preserving Plants

The best railroads *specify* treated ties. Why not own your own plant and save money?



TREATING CYLINDER

We design and build Complete Plants, Cylinders, Tanks, Tie Cars, etc.

Write for Bulletin 1439-A

Allis-Chalmers Manufacturing Co.

For all Canadian Business refer to Canadian Allis-Chalmers, Ltd., Toronto, Ont., Canada.

MILWAUKEE, WISCONSIN

They Resist Time Itself

Improved O. G. Fir Gutters

"The Everlasting Kind"

E. M. LONG & SONS CADIZ OHIO — IMPROVED — O. G. FIR GUTTERS

Twenty-five years of service without a dollar for repairs is not an unusual record for Improved O. G. Fir Gutters. The reason is the wood. Made of straight grain, decay resisting Douglas Fir, they are immune to the ravages of time and the action of the elements, smoke and chemical fumes.

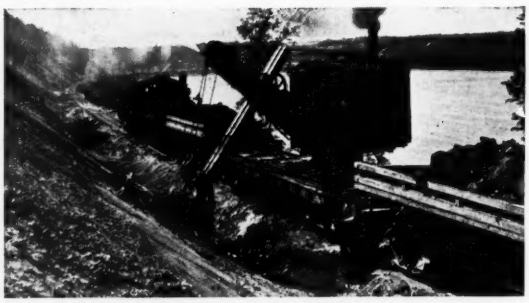
Lower in first cost than copper or tin while the maintenance costs of either means a double saving.

Write for our booklet on "Gutter Facts."

E. M. Long & Sons, Cadiz, Ohio

Marion

Railroad Ditchers



Model 15 Marion Ditcher on Canadian Pacific Railway

Three Big Marion Advantages

FIRST: *Independent Boom Engines.* A Marion Ditcher is able to dig through a considerably wider range because of its independent boom (or crowding) engines, thereby saving time of moving back and forth along the bank. It is also able to dig much harder material for the same reason, because of the more positive action of the dipper handle.

SECOND: *Independent Swinging Engines.* A Marion Ditcher is better able to hold its position on curves while digging. The swinging motion is positive in either direction and is not controlled by frictions or similar devices.

THIRD: *A Marion Ditcher may be easily changed into a small revolving steam shovel for work on the ground.* A truck frame for railroad wheels or traction wheels can be substituted for the regular ditcher truck frame, and the ditcher becomes a revolving shovel, suited to a revolving shovel's wide range of work.

These three are only a few of the many points of Marion Ditcher Superiority. Marion Excavating Machinery is being used on hundreds of railroads in the United States and abroad, which is good evidence of its efficiency.

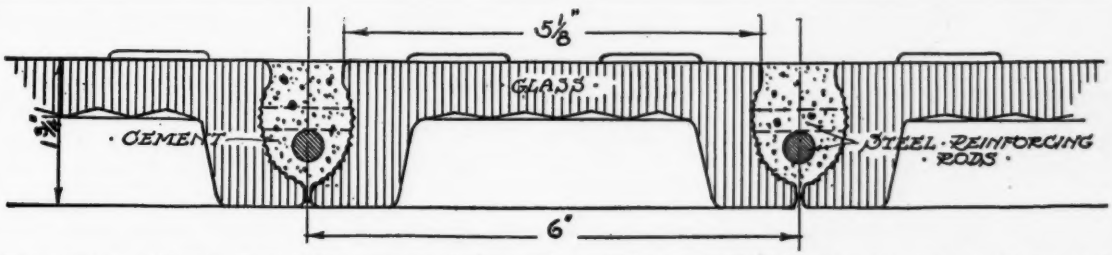
THE MARION STEAM SHOVEL COMPANY

Established 1884 MARION, OHIO

Atlanta Chicago New York San Francisco Seattle

Manufacturers of Excavating Machinery of Every Description

KEPPLER



Cross section of Keppler Roof Lights showing all-glass surface. Units are 1¾" thick, 6" square, and supported by 1:2 concrete mortar ribs reinforced by steel rods. Weight 16 pounds per square foot. Ultimate carrying capacity of 350 pounds per square foot on a 5-foot span.

Upkeep free for 1 year; nominal sum per year thereafter.

the roof lights that cut maintenance costs

Roof Lights for train sheds, stations, etc., have been sold on the wrong basis. The emphasis has been on the *first cost per square foot.* Result—maintenance has been high, renewals frequent, and cleaning difficult.

Keppler Roof Lights put the emphasis where it belongs—on plenty of light, *lowest final cost,* including maintenance and renewal, ease of cleaning, fire-protection and permanence.

The Lehigh bought 50,000 sq. ft. for the new Buffalo train shed

The Lehigh bought 50,000 *square feet Keppler Roof Lights for the new Buffalo Train Shed* because of "greater permanence, minimum cost of maintenance and exceptional lighting value."

They also have been chosen for the Lackawanna Station, Buffalo; Pennsylvania Station, Johnstown, Pa.; Lehigh Station, Buffalo; Lehigh Round House, Sayre, Pa., etc., etc.

Send the coupon for Bulletin 205

The coupon is for your convenience in requesting information. If you will fill in and return it, we will send you booklets giving details showing roof-light construction of the Lehigh Valley Train Shed at Buffalo, N. Y.

Send me Bulletin 205 and detail sheets.

Name.....

Address.....

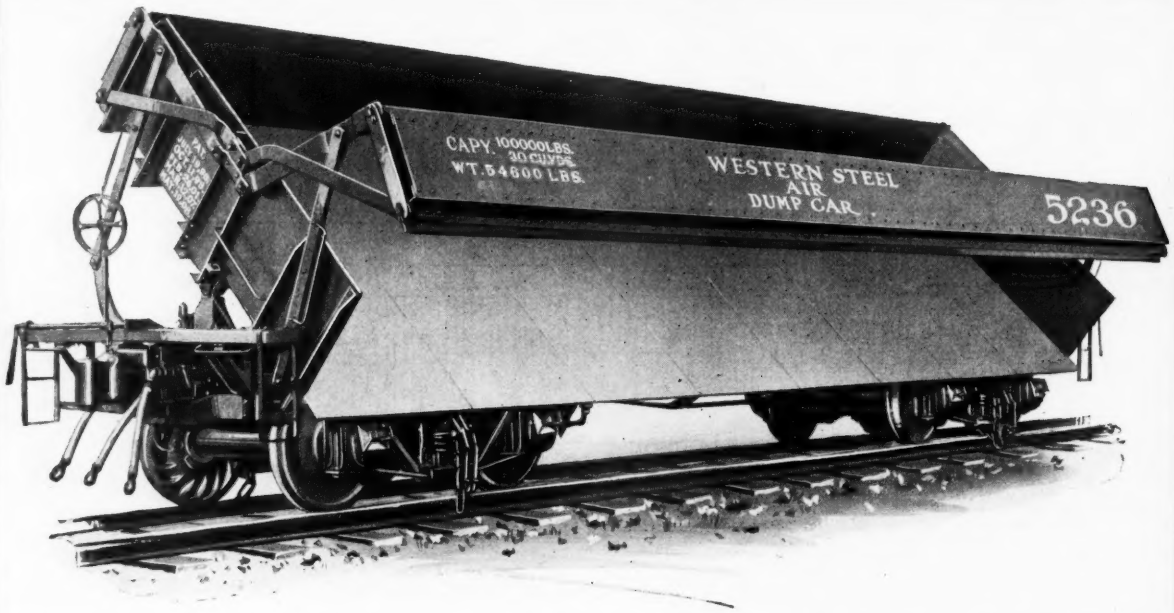
Railroad.....

KEPPLER GLASS CONSTRUCTIONS, INCORPORATED, NEW YORK.

Keppler Glass Constructions, Inc.

101 Park Avenue, New York

KEPPLER
Glass Constructions N Y



Large Capacity Dump Cars

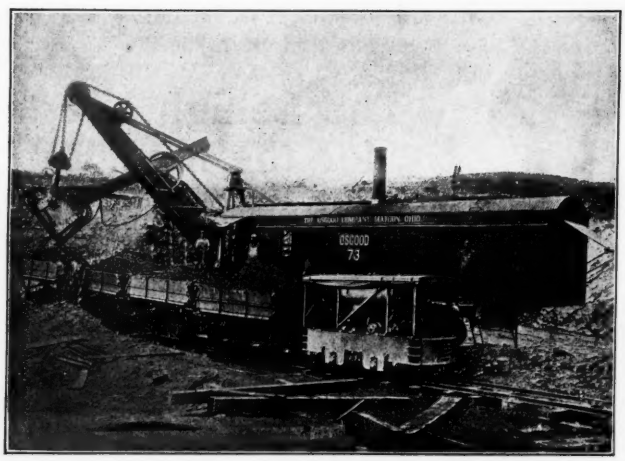
Can be dumped as quickly and as cheaply as smaller cars and their enormous loads effect a big reduction in the dead weight of train per ton of material handled. Particularly adapted to long-haul jobs on congested lines. Write for our handsomely illustrated catalog; it contains much valuable information.

WESTERN WHEELED SCRAPER CO., Aurora, Illinois

The OSGOOD "73"

3½ yard Steam Shovel is the practical shovel for HEAVY RAILROAD WORK.

Shipping weight 82 tons.



This shovel is new and modern in every respect, and embodies all the latest features in steam shovel construction, such as steel gears with machine cut teeth; manganese racks and pinions for dipper handle; manganese dipper front with renewable manganese lip; cast steel swinging circle; heavy front end construction; especially strong boom; large boiler and water tanks; long car frame; enclosed firing platform; steam hoisting friction; by-pass throttle, etc. In fact, all the improvements that have been found desirable for strength, capacity, maintenance and ease of operation.

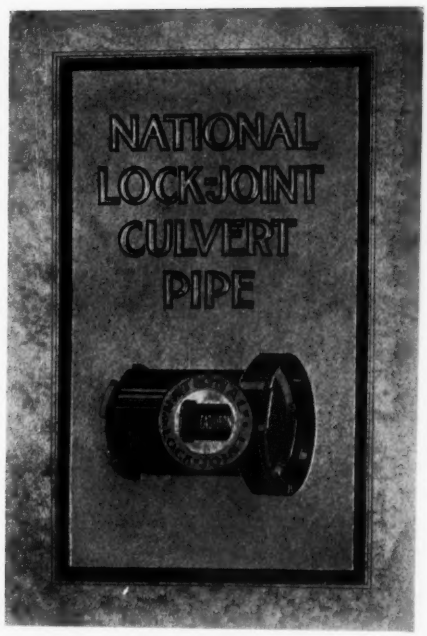
Steam Shovels, all sizes, Deep Water and Ditching Dredges

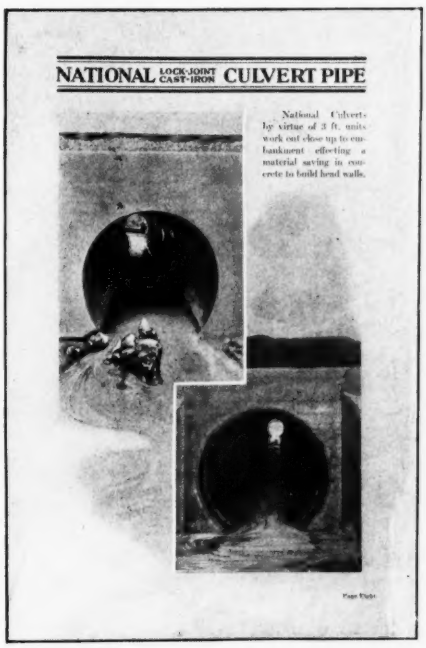
THE OSGOOD COMPANY, MARION, OHIO

EASTERN OFFICE: 51 STATE ST., ALBANY, N. Y.

REPRESENTATIVES

J. M. Reed Co., Inc., Philadelphia.
M. E. Davis, New York City.
The Equity Equipment Co., Cincinnati, Ohio.
Norman B. Livermore & Co., San Francisco and Los Angeles.
Northwestern Equipment Co., Portland and Seattle.
S. G. Elbe, Denver.
Copeland & Klingel, Minneapolis.
The Utah Machinery Co., Salt Lake City.
The M-C-B Company, Chicago.
Kelly Powell Limited, Winnipeg and Montreal.
H. S. Johannsen, Export Agent, New York City.





Why Every Engineer Needs This Booklet!

This booklet will tell you in a few minutes many of the things that you want to know about NATIONAL LOCK-JOINT CAST IRON CULVERT PIPE. It is full of illustrations showing installations—mechanical drawings and tables noting comparison in weight per unit. Furthermore, there are tracings showing standard methods of placing cast iron pipe on leading railroads.

Send For It To Day No Expense To You

Send for this booklet and learn how the Illinois Central Railroad specifies for placing Cast Iron Pipe. Then there are the letters from engineering departments that have used National Lock-Joint Cast Iron Pipe. Every engineer ought to read these letters; for they prove conclusively that National Lock-Joint Cast Iron Pipe is mechanically correct and the solution to the culvert problem in railway work. Again we say, every engineer ought to send for a copy of this booklet—it costs you nothing.

AMERICAN CASTING CO.
Birmingham, Ala.
Chicago Office: - Peoples Gas Building
New England Representative
Fred A. Haudlette & Son - Boston, Mass.
St. Louis Representative
H. P. Webb - - Wainwright Building
St. Paul Office
Contractor's Supply and Equipment Co.

Tell It Here—

The Railway Maintenance Engineer reaches the buying organizations of the most important operating railways of the United States and Canada—

It reaches 'em all along the line from the section foreman up to the Engineer of Maintenance of Way.

Maintenance of Way materials are required for over 295,000 miles of railway in the U. S. and Canada.

The annual expenditure runs into the hundreds of millions.

If you make or sell anything for the Maintenance of Way Department, tell the buyers about it here —in the advertising pages of the

Railway Maintenance Engineer